METHOD AND ORDER IN RENAISSANCE PHILOSOPHY OF NATURE

The Aristotle Commentary Tradition

Edited by
Daniel A. Di Liscia
Eckhard Kessler
Charlotte Methuen

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INTRODUCTION

Eckhard Kessler

Until the 1940s it was generally accepted by historians of Renaissance philosophy that the dynamics of philosophical progress during the Renaissance had been directed at overthrowing the Aristotelian tradition, until ultimately, deprived of any invigorating new blood, Aristotelianism fell victim to its own senility.[1] Even Pierre Duhem, the first to claim Aristotelian origins for Galileian science, believed it to have been the remnants of the medieval tradition, preserved unnoticed through two centuries of ineffective Renaissance philosophy and literary preoccupations, which provided the roots of modern science.[2]

It was not until 1940, when John Herman Randall published his article "The development of scientific method in the school of Padua,"[3] in which, drawing to some extent upon the work of Ernst Cassirer,[4] he presented the methodological discussions of the Paduan Aristotelians as a vigorous and fruitful undertaking which directly influenced Galileo, that a growing number of Renaissance scholars were stimulated to take Renaissance Aristotelianism seriously and to investigate its tradition.

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[1] See E. Kessler, "The Transformation of Aristotelianism during the Renaissance," in: J. Henry and S. Hutton (eds.), *New Perspectives on Renaissance Thought: Essays in the History of Science, Education and Philosophy in Memory of Charles B. Schmitt*, London 1990, 137-47.

[2] See P. Duhem, *Les Origines de la statique*, 2 vols., Paris 1905-06; idem, *Études sur Léonard de Vinci*, 3 vols., Paris 1906-13; idem, *Sozein ta phainomena. Essai sur la notion de théorie physique de Platon à Galilée*, Paris 1908 (Engl.: *To save the phenomena*, Chicago 1969); idem, *Le Système du monde*, 10 vols., Paris 1913-59.

[3] J. H. Randall, "The development of scientific method in the school of Padua," in: *Journal of the History of Ideas* 1 (1940), 177-206, reprinted in: idem, *The School of Padua and the Emergence of Modern Science*, Padua 1961.

[4] C. B. Schmitt, *A Critical Survey and Bibliography of Studies on Renaissance Aristotelianism 1958-1969*, Padua 1971, 42; E. Cassirer, *Das Erkenntnisproblem in der Philosophie und Wissenschaft der neueren Zeit*, vol. 1, 1906; ^{3}1922, repr. Darmstadt 1974.

There is no need to recall all those who were involved, and it is surely scarcely necessary even to mention the most influential. Nonetheless we remember Charles Schmitt, whose *Critical Survey and Bibliography of Studies of Renaissance Aristotelianism*, published in 1971,[5] and *Aristotle and the Renaissance* (1983)[6] brought together the results of a diverse and widely dispersed body of scholarship and served as an incentive to more extended and intensive studies on Renaissance Aristotelianism; Charles Lohr, who not only took over sole responsibility for the composition—if that is the right word—of the article on Aristotle for the *Catalogus Translationum et Commentariorum* after Charles Schmitt's untimely death in 1986, but who has also provided an indispensable tool for all Renaissance scholars in the shape of his *Medieval and Renaissance Latin Aristotle Commentaries*;[7] William Wallace, who in his numerous books and articles has transformed and, in transforming, defended Randall's thesis that the origin of Galileo's method is to be found in the Aristotelian concept of *regressus*;[8] and Luce Giard, who represents and incorporates research in Renaissance Aristotelianism in France.[9] Thanks to the efforts of these and many other eminent scholars over the course of what is now over fifty years since Randall's first publication the understanding of Renaissance Aristotelianism has been transformed.[10]

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[5] Schmitt, *A Critical Survey* (as note 5).

[6] C. B. Schmitt, *Aristotle and the Renaissance*, Cambridge, Mass., 1983.

[7] C. H. Lohr, "Medieval Latin Aristotle Commentaries," in: *Traditio* 23 (1967) to 35 (1974); idem: "Renaissance Latin Aristotle Commentaries," in: *Studies in the Renaissance* 21 (1974) and *Renaissance Quarterly* 28 (1975) to 35 (1982), reprinted as *Latin Aristotle Commentaries II: Renaissance Authors*, Florence 1988. See also E. Cranz, *A Bibliography of Aristotle Editions 1501-1600*, Baden-Baden 1971.

[8] Wallace's most recent comprehensive study—including an extensive bibliography—is *Galileo's Logic of Discovery and Proof: The Background, Content, and Use of His Appropriated Treatises on Aristotle's Posterior Analytics*, Dordrecht 1992; for Galileo's relationship with Randall see William A. Wallace: "Randall Redivivus: Galileo and the Paduan Aristotelians," in: *Journal of the History of Ideas* 48 (1988), 133-49.

[9] See L. Giard, "L'Aristotélisme au XVI^{e} siècle," in: *Les Etudes Philosophiques* 1986, Nr. 3, 281-405.

[10] See Schmitt, *A Critical Survey* (as note 5), 38-46.

Randall concentrated his studies on Padua in the fifteenth and sixteenth centuries, analysing the works of Aristotelian professors there, from Paul of Venice to Jacopo Zabarella, for their possible contribution to the emergence of the modern concept of scientific method, and identifying the discussion of *regressus*[11] as the main and universal cause of modern science. Those who have followed him have asked whether this fruitful development within Renaissance Aristotelianism was really confined to Padua, or whether, as all scholars now seem to agree, it spread all over Europe, so that research has to be extended likewise to all cultural centres of the time. They have asked too whether the achievements of Renaissance Aristotelianism were due exclusively to developments peculiar to the two centuries considered by Randall, or whether they were linked to the preceding Aristotelian traditions in such a way that research must transcend the chronological boundaries of the Renaissance to consider the heritage of the Middle Ages and Late Antiquity. Further, they have asked whether methodology was the one and only achievement of Renaissance Aristotelianism, or whether—as for instance Charles Lohr has proved in the case of natural philosophy[12]—there are other topics which deserve attention as contributions of Renaissance Aristotelianism to the progress of philosophy and science.

Alongside this broadening of the field of research, doubts have been expressed as to whether the theory of *regressus* as it developed in the Aristotelian tradition should indeed be regarded as the origin of Galileo's concept of method, or whether—as for instance Nicholas Jardine has maintained[13]—the background of Galileo's method is the geometrical tradition as in Pappus Alexandrinus,[14] in which case the discussion of

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[11] A comprehensive study of the *regressus* at Padua is Giovanni Papulli: "La teoria del 'regressus' come metodo scientifico negli autori della Scuola di Padova," in: L. Olivieri (ed.): *Aristotelismo Veneto e Scienza Moderna. Atti del 25º Anno Accademico del Centro per la Storia della Tradizione Aristotelica nel Veneto*, 2 vols., Padova 1983, vol. I, 221-78.

[12] See C. H. Lohr, "The Sixteenth-Century Transformation of the Aristotelian Natural Philosophy," in: E. Kessler, C. Lohr and W. Sparn (eds.), *Aristotelismus und Renaissance. In memoriam Charles B. Schmitt* (Wolfenbütteler Forschungen 40), Wiesbaden 1988, 89-100.

[13] See N. Jardine, "Galileo's road to truth and the demonstrative regress," in: *Studies in History and Philosophy of Science* 7 (1976), 277-318.

[14] See Pappus Alexandrinus, *Mathematicae Collectiones, a Federico Commandino Urbinate in Latinum Conversae et Commentariis Illustratae*, Venetiis 1588, Lib.

regressus cannot be said to have had any immediate impact upon the emergence of modern science. The spectrum of questions directed at Randall's thesis seems to entitle us to assert that Randall's original hypothesis has been questioned in all its major points. At the same time, however, the very fact that it has been questioned in nearly every respect serves also to demonstrate its provocative force and powerful impact on Renaissance scholarship during the last fifty years.

Renaissance Aristotelianism has thus become an interesting subject for the history of philosophy in its own right. It is no longer necessary, as it was in the days when Randall first uncovered its philosophical vigour, to defend research in the philosophical tradition of Renaissance schools and universities by emphasising its impact on and contribution to modern philosophical or scientific developments. We have learned to analyse and judge Renaissance philosophy according to its own standards and its capacity to solve in a reasonable way the problems which it set itself or which follow from its own principles.[15]

Released from their roles as forerunners to later thinkers of whom they could not even have dreamt, Renaissance philosophers are now free to enter the scene as autonomous actors in the drama of human thinking. A plethora of hitherto unnoticed texts and as yet unasked questions gains weight and begins to occupy the attention of the scholarly world. Randall's approach to the Renaissance discussion on method, which resulted in the rediscovery of the *regressus*, was guided by the question of the service it might have rendered Galileo and his followers. An unbiased perspective on this discussion does not lead us to deny the methodological importance of the regressive procedure, but it does situate this discussion in the context of the whole Aristotelian tradition since the times of late Antiquity and the Middle Ages, and allows the observer to look beyond the method of *regressus* to the full variety and ingenuity of Renaissance methodological discussion.

The papers collected in this volume are the result of a two-week postgraduate seminar entitled *Method in Sixteenth-Century Aristotle*

VII, 157 ff.; for Pappus' method see J. Hintikka and U. Remes, *The Method of Analysis: its Geometrical Origin and its General Significance*, Dordrecht 1974.

[15] This, indeed, was the criterion for the editors of *The Cambridge History of Renaissance Philosophy* (Cambridge 1988). See C. B. Schmitt, "Towards a History of Renaissance philosophy," in: Kessler et al (as note 12), 9-16, esp. 13ff.

Commentaries, which was sponsored by the *Foundation for Intellectual History*, London and accomodated by the *Herzog August Bibliothek* at Wolfenbüttel in September 1992. Their variety demonstrates better than any theoretical reflection that, once we leave the narrow borders of the theory of *regressus* behind us, we enter a vast field of research which is confined neither to the notion of method in the strict sense, nor to the Renaissance in its exact historical limits, nor yet to the Aristotelian tradition as a well-defined philosophical school. If we want to do justice to Renaissance discussions on method in their historical and systematic context, we thus have constantly to go beyond the limits of concepts, ages and schools. The title we have chosen for this volume is *Method and Order in Renaissance Philosophy of Nature: The Aristotle Commentary Tradition.* That this was not the title of the seminar is intentional: this difference is meant to represent the dynamic of our discussions and the changes in ideas and interpretations wrought by the seminar.

The *Foundation for Intellectual History* most generously made it possible for twenty-four senior scholars, junior scholars and guests from thirteen different countries to come together and devote two weeks of intensive work to the research and discussion of their common interests. The *Herzog August Bibliothek* shared its resources of books, experience and human warmth in a most thoughtful and obliging way to the benefit of us, its guests. It is a privilege to be able to thank both institutions and particularly Constance Blackwell from the *Foundation* and Sabine Solf, Friedrich Niewöhner and Brigitte Braun from the *Bibliothek.*

PHILOPONUS AND SIMPLICIUS ON TEKMERIODIC PROOF

Donald Morrison

> ... in the science of nature too our first task will be to try to determine what relates to its principles. The natural way of doing this is to start from the things which are more knowable and clear to us and proceed towards those which are clearer and more knowable by nature; for the same things are not knowable relatively to us and knowable without qualification. So we must follow this method and advance from what is more obscure by nature, but clearer to us, towards what is more clear and more knowable by nature. Now what is to us plain and clear at first is rather confused masses, the elements and principles of which become known to us later by distinguishing them.[1]

These remarks concerning method in natural philosophy have been extremely influential through the ages, and are famously obscure. Their obscurity has been in a way an asset to the history of philosophy. Later philosophers have been able to read into Aristotle's words whatever precise and elaborate theory of our knowledge of the principles of nature seemed to them best, even when their constructions go far beyond what Aristotle himself had in mind. As with Plato's statements concerning the theory of ideas and Wittgenstein's on language-games, the frustrating inadequacy of what Aristotle says is a source of philosophical fertility, for his remarks are deeply suggestive without being especially constraining.

This text raises many problems and issues, each of which has its own complicated history.[2] In this paper I shall concentrate on a small but crucial episode in the development of one significant issue: the method by which the physicist acquires knowledge of the principles of physical things.

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[1] Aristotle, *Physics* 1.1, 184a15-22.

[2] The most detailed account of the various issues is J. Fritsche, *Methode und Beweisziel im ersten Buch der 'Physikvorlesung' des Aristoteles,* Frankfurt 1986. A useful recent study is R. Bolton, "Aristotle's Method in Natural Science: *Physics* 1," in: L. Judson (ed.), *Essays in Aristotle's Physics*, Oxford 1991, 1-30.

In his commentary on the *Physics*, the sixth-century Neoplatonist philosopher Simplicius puts forward sign-inference as a general method for acquiring first principles in physics: "Clearly, the grasp (*gnôsis*) of the principles [of physical things] is through necessary signs (*tekmêriôdês*) rather than apodeictic (*apodeiktikê*)."[3]

As it happens, the word that I have translated "through necessary signs"—*tekmêriôdês*—is a rare word in Greek. (For convenience, instead of translating I shall from now on employ the neologism "tekmeriodic", in parallel to the already well-established coinage "apodeictic".) The earliest occurrence is in Aristotle's *Rhetoric*—not his *Physics*. With one minor exception,[4] the word does not occur again until the sixth century A.D., in commentaries by Damascius, Philoponus, and Simplicius. These three philosophers all studied with Ammonius son of Hermias, an influential head of the Neoplatonist school at Alexandria. Using this word as a signpost allows one to trace rather precisely at least part of the evolution of one aspect of the commentators' interpretation of Aristotle's remarks on method. Although, as we shall see, the commentators' "tekmeriodic interpretation" of Aristotle is partly over-interpretation and partly misinterpretation, it nonetheless had a long and fruitful afterlife, down to Zabarella's and Galileo's famous theories of resolutive method in the sixteenth century and beyond.[5]

1 Enthymeme

1.1 Aristotle's Rhetoric and Prior Analytics

At *Rhetoric* 2.25 1403a10-12 Aristotle says that necessary signs (*tekmêria*) and tekmeriodic enthymemes (*tekmêriôdê enthumêmata*) cannot be refuted on the grounds that they are non-deductive. What Aristotle means by tekmeria and tekmeriodic enthymemes can be pieced together with the aid of his discussions of enthymeme at *Rhetoric* 1.2 and *Prior Analytics* 2.27, where Aristotle uses the word *tekmêrion,* but not *tekmêriôdês.*

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[3] Simplicius, *In Phys.*, 18.28-29.

[4] The exception is a 5th century report of Stoic doctrine in Stobaeus (*Anth.* 1.50(42) I, 4 77,15 Wachsmuth=*Dox. Gr.* 398b22=*SVF* I, 204. One should not infer from Stobaeus' report that the term *tekmêriôdôs* was used by the early Stoics, and it is dangerous even to conclude that the term was used by Stobaeus' presumed source, Aetius. Since the type of grasping which Stobaeus' report describes as *tekmêriôdôs* is physiognomic inference from effect to cause, it is nonetheless possible that this report reflects an interpretation of Aristotelian tekmeriodic syllogism as an inference from effect to cause that was already established by Aetius' time (first to second century A.D.).

[5] For an interesting recent study of creative misinterpretations of Aristotle's *Physics* by his ancient and mediaeval commentators, see H. Lang, *Aristotle's* Physics *and its Medieval Varieties*, St Albans 1992.

An enthymeme is a rhetorical syllogism (1356b5). What makes a syllogism an enthymeme is the context of its use. The same set of propositions, set in a dialectical context, may be a refutation; in a scientific context, a proof (*apodeixis*); and in a rhetorical context, an enthymeme. Handbooks of Aristotelian logic often state that an enthymeme is an incomplete syllogism, but this is not Aristotle's usage. The enthymeme is the complete syllogism, though it is sometimes rhetorically effective to leave part of it unstated.[6]

A sign (*sêmeion*) is a proposition stating that if one thing, A, is, was, or comes to be, then another thing, B, is, was, or will be (*An. Pr.* 1.27. 70a6). Aristotle also calls a "sign" the thing or fact or event (*pragma*) A whose existence or occurence permits one to infer the existence or occurence of B. One crucial distinction Aristotle makes is between signs that hold only for the most part, and signs that hold always and necessarily. Aristotle calls the former signs *sêmeia,* and reserves the term *tekmêria* for necessary signs (*Rh.* 1357b3-5; 1402b12-21; *An. Pr.* 70a6-9, b1-6.)

A tekmeriodic enthymeme is possible only in the first figure. For example: if a woman has milk, she has given birth.[7] (Or: all women who have milk have given birth.) This woman has milk. Therefore this woman has given birth. In this example having milk is the *tekmêrion*, or necessary sign, of giving birth. The tekmeriodic enthymeme, alone of the various enthymemes based on examples, probabilities, and signs, is irrefutable. "If it is clear that [the alleged fact] holds, and that it is a

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[6] The mistake is ancient. *Atelês* is included in the lemma at Philoponus, *In An. Pr.* 481,19; see also the apparatus of Ross' edition *ad* 70a10, Alexander *In Top.* 62.9-13, and Quintilian, *Inst. Or.* V.10.3. For the history and significance of this mistake, see now M. Burnyeat, "Enthymeme: Aristotle on the Logic of Persuasion," in: D. Furley and A. Nehamas (eds.), *Aristotle's Rhetoric: Philosophical Essays*, Princeton 1994, 3-55.

[7] For the origin and early history of this example, see T. Ebert, "The Origin of the Stoic Theory of Signs in Sextus Empiricus," in: *Oxford Studies in Ancient Philosophy* 5 (1987), 83-126.

tekmêrion, this now becomes irrefutable; for this is then a demonstration that is clear in every respect" (*Rh.* 1403a14-16).

Thus as Aristotle defines it a tekmeriodic enthymeme is any valid rhetorical syllogism having a universally quantified assertoric major premise, and of which both premises are clear to the audience. One feature of Aristotle's definition which will be important later is that this definition leaves the causal relationship between sign and signified undetermined. The example of having milk and having given birth is naturally understood as a case in which the sign A (having milk) is the effect of the signified B (giving birth). But sign-premises in which A is the cause of B, or in which both A and B are effect of some common, unspecified cause X, are also possible, and sign-premises of these types can also function in tekmeriodic enthymemes. Aristotle would presume that the fact that all A are B has some explanation, so there will be some (Aristotelian) causal account in which A and B both figure, but the range of possibilites for such accounts is left completely open by Aristotle's definition.[8]

Aristotle's examples of tekmeriodic syllogisms in the *Prior Analytics* include two types: (1) those with universal subjects throughout; and also (2) those with singular subjects in the minor premise and the conclusion. An example of the first type is given at the end of the chapter (70b32-37), where Aristotle discusses the use of tekmeriodic inference in judging character from physical features. The example: All animals that have large extremities are courageous; all lions have large extremities; therefore all lions are courageous.[9] An example of the second type is given at

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[8] Pace e.g. D. Ross, *Aristotle*, London ^{5}1964, 41. J. Sprute, *Die Enthymementheorie der aristotelischen Rhetorik*, Göttingen 1982, 101-3, suggests that A and B in the sign-premise of an Aristotelian tekmeriodic enthymeme are connected by the relation Aristotle calls "hypothetical necessity" (*anangkê ex hypotheseôs*). But this scientific notion is too narrow to fit rhetorical theory. It is true that in a tekmeriodic sign-premise B is a normally a necessary condition for A, where "necessary condition" has the sense given it by the theory of material implication in modern logic. (It is always a sufficient condition, else the tekmeriodic inference would not be valid.) But (without going into the details) Aristotle's notion of hypothetical necessity is a much narrower notion, implying a precise causal relation, normally involving final causality. Aristotle's tekmeriodic enthymeme includes many more cases than those Aristotle would recognize as involving hypothetical necessity.

[9] Physiognomy is one of several ancient "sciences" which depended largely or entirely on sign-inference. (Astrology and medicine were others.) The necessary connection between effect and cause that tekmeriodic inference requires is

70a23-29: Ambitious men are generous; Pittacus is ambitious; Pittacus is generous.[10] In the *Rhetoric*, such examples are natural, since the subject-matter of speeches are normally singulars: a certain person's life or conduct; a certain action or series of actions to be undertaken at a certain time. But the use of singular subjects fits awkwardly in the *Prior Analytics*, since Aristotle's official theory of the syllogism only recognizes syllogisms with general subjects such as "all men", "some plants".

For the tekmeriodic enthymeme to function, both premises must be clear to the audience. This means that the audience must not only know the fact (e.g. that Pittacus is ambitious), but also the general statement expressing the relation between sign and signified (that all ambitious men are generous). Aristotle's rhetorical theory does not envision an audience of experts or professionals, but rather of ordinary Greeks. So the audience's grasp of e.g. the fact that all ambitious men are generous is not the scientific knowledge that a professional psychologist might have. Rather, it is a weaker cognition based on common opinion and repeated personal observation.

1.2 Quintilian and Cicero

Since the earliest surviving Greek commentaries on Aristotle's *Rhetoric*, and on the second book of the *Prior Analytics*, are all quite late, our earliest evidence for the reception of Aristotle's doctrine of tekmeriodic enthymeme is Quintilian. In his *Institutio Oratoria* , Quintilian reports: "Signs of the first type are those which cannot be otherwise, which the Greeks call 'tecmeria'. These are aluta semia."[11]

Who are these "Greeks"? Quintilian's remark is evidence that the use of *tekmêrion* to mean "necessary sign" was a commonplace in the Greek rhetorical schools of his time.[12] However this does not imply that

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affirmed by the author or authors of pseudo-Aristotle, *Physiognomica*, at 1,1 805a=I 6,1-5 Foerster and 808b11-15=I 40,1-5 Foerster. Ancient physiognomics is well surveyed in E. Evans, *Physiognomics in the Ancient World* (Transactions of the American Philosophical Society 59/5), Philadelphia 1969.

[10] Aristotle's two other examples of this type are : fever and illness (*Rhet.* 1357b14-16); and having milk and childbearing, *Rhet.* 1357b15-16 and *Pr. An.* 70a13-15.

[11] Quintilian, *Inst. Or.* V, 9, 13=T. III, 123 Cousin.

[12] Quintilian relies frequently on Hermagoras in this section of the *Inst. Or.*, and Matthes includes the present text in his edition of Hermagoras (frag. 8). However one should not assume that in making his statement Quintilian is relying solely on

tekmêrion was used in this technical sense in Greek philosophy in general, or indeed anywhere outside of treatises and handbooks of rhetorical theory. Even Aristotle used *tekmêrion* in this technical sense only when presenting his theory of enthymeme. Everywhere else, Aristotle uses the word *tekmêrion* in an ordinary or casual sense, whereby to call something a *tekmêrion* is to say that it is a good reason for some conclusion. In slightly more formal terms, Aristotle will call X a *tekmêrion* of Y if X is the salient premise in his argument for Y, where the argument may be of any type whatever: probable, dialectical, from effect to cause, from cause to effect, and so on.[13]

In the absence of any evidence, apart from Aristotle's own statements of rhetorical theory, that the term *tekmêrion* was used in this technical sense by Greek philosophers in the period up through the first century A.D., the proper conclusion to draw is that Quintilian, a rhetorical theorist, is basing his report solely on Greek rhetorical handbooks. *Graeci* here means "Greek rhetorical theorists".[14]

Neither the term *tekmêrion* (or any Latin equivalent) appears when Cicero presents a related form of argument. In Cicero's *Topica*, he twice mentions a topic "what is effected by causes."[15] Cicero describes the topic thus: "For just as the cause shows what has been effected, so what has been effected points out what the cause was."[16] Unfortunately, Cicero says almost nothing more on the subject, and his description of this form of argument did not have any influence (that I have so far been able to trace) until Martianus Capella.

Hermagoras. For a roughly contemporary parallel, see the Anonymous Seguerius, who is relying on Neokles: *Rhet.Gr.* I, 2, 379, 12-15 (para. 151).

[13] A few examples: *de Cael.* 291a8; 294b22; *EE* 1223b27; *GA* 721b13; 744a11; *HA* 628b21; *Metaph.* 1093b25; *Mete.* 359a11; 367a11. In one case, where the *tekmêrion* is meant to be a necessary sign, Aristotle says so explicitly: *de Cael.* 277a12.

[14] We do have remarks in Byzantine sources that are similar to Quintilian's: Suda, 245.1 Adler; Psellus, *Sullogai* 35, 21; John the Deacon, 136 Raabe. According to the apparatus and introduction of his edition, Adler believes that the Suda's source for the entries on *tekmêriodês apodeixis* and *tekmêrion* is Philoponus' *In de An.* Proclus' teacher Syrianus employs the notion at *In Herm.* II 156, 18-19; and II 62,7 may also refer to the same idea.

[15] Cic. *Top.* IV, 23; XVIII, 67.

[16] Cic. *Top.* XVIII, 67.

1.3 The tradition of commentary on the *Rhetoric* and *Prior Analytics*

Unfortunately, the two *Rhetoric* commentaries in the *Commentaria in Aristotelem Graeca* (one anonymous, and one by a certain Stephen, probably of Constantinople) are both late, probably 12th century A.D.[17] Naturally both rely on earlier commentaries, so that material in them may have originated many centuries before.

Both commentaries show awareness that Aristotle discusses a single topic, the tekmeriodic enthymeme, in all three passages mentioned earlier: *Rhet.* 1.2 1357b1; 2.25 1402b13-1403a15, and *Pr. An.* 2, 27 70a3-70b38. But what is most notable about both these commentaries on the *Rhetoric* is how conservative they are, how little interpretive material they add to Aristotle's text.[18] There is no trace in either commentary of "tekmeriodic proof" as a method of acquiring knowledge.

The only surviving Greek commentary of the second book of the *Prior Analytics* is that by John Philoponus.[19] Although the commentary as a whole is substantial, his comments on the tekmeriodic enthymeme are thin.

In Philoponus' commentary on the *Posterior Analytics*, he refers to the "tekmeriodic syllogism" repeatedly. Therefore it is striking that in his commentary on *Prior Analytics* II 27, he does not use the term *tekmêriodes* at all.[20] The examples of necessary signs that Philoponus uses include: (1) ash as a *tekmêrion* of fire (*In Pr. An.* 481, 11); (2) smoke as a *tekmêrion* of fire (481, 10); (3) having milk as a *tekmêrion* of being about to give birth in two days' time (481, 12-13); and (4) having milk as a *tekmêrion* of being pregnant (481, 25).

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[17] Note that Stephen of Alexandria, the author of a commentary on the *De Int.*, is a different person altogether. The late date of the author of this *Rhetoric* commentary is shown, e.g. by his use of the Suda (*In Rhet.* 285, 180). See Rabe's preface to Stephanus, in: H. Rabe (ed.) *In Artem Rhetoricam Commentarium*, Berlin 1896, CAG 21, XIII, and "Stephanos 11," in: *RE* IIIA 2364-2369.

[18] The anonymous commentator adds an additional example to those mentioned by Aristotle: "Where there is ash, there was fire." Since this was a stock example of sign inference, it is not surprising that it should have crept into a *Rhetoric* commentary. In another place, the anonymous commentator adds this example: that deeds (*erga*) are *tekmêria* of the actions (*praxeis*) that produce them (*In Rhet.* 55, 25). In contrast to the commentator's enthusiasm for such inferences, Aristotle's text (1367b32) seems to imply the more plausible view that deeds are mere *sêmeia*, i.e. probable signs, of the actions that produce them.

[19] For a general introduction to Philoponus, see the essays collected in R. Sorabji, *Philoponus and the rejection of Aristotelian Science,* Ithaca 1987.

[20] One possible explanation of the difference might be this. Four of Philoponus' commentaries begin with a remark that they are "from the voice of" Ammonius, i.e. based on his lectures. These are: *In An. Pr., In An. Post., In DA,* and *In GC.* The last three add that they contain some reflections of Philoponus' own; whereas the *Pr. An.* commentary lacks this added comment. One might suppose that the

2 The theory of tekmeriodic proof

2.1 Commentaries on the Posterior Analytics

When one turns to the commentaries on Aristotle's treatises concerning science, suddenly everything changes. The commentators employ a theory of the tekmeriodic syllogism which is heavily loaded with new baggage, not found in Aristotle.

In the *Rhetoric* and *Prior Analytics* commentaries, Aristotle's phrase "tekmeriodic enthymeme" was extended to "tekmeriodic syllogism". In the *Posterior Analytics* commentaries, "tekmeriodic enthymeme" disappears—appropriately enough, since rhetoric is no longer under discussion. "Tekmeriodic syllogism" continues,[21] along with a new term: "tekmeriodic proof (*apodeixis* or *deixis*)".[22]

A tekmeriodic proof differs from a proper, scientific proof by being back to front. It is used to argue from effect to cause, from "posteriors" to "priors". At the beginning of the most extensive surviving discussion of the tekmeriodic proof, Philoponus describes it as follows: "It often happens that one produces conviction (*pisteis*) of the prior things out of posteriors, because, as I said, the prior things are not better know to us. And this form of proof is called tekmeriodic and irrefutable."[23]

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reason Philoponus uses the term *tekmêriodês* in his *Pos. An.* commentary, but not in the *Pr. An.* commentary is that in the latter commentary he is keeping himself strictly to Ammonius' remarks, and Ammonius did not use the term. However, I do not believe that the absence of the added comment need imply any diffence in Philoponus' procedure. And if Ammonius did not use the term in his lectures on the *Pr. An.*, the puzzle is simply pushed back a step further. Since Ammonius clearly used the term and taught the doctrine (see sect. 2.3 below), if he did not employ it in his lectures on the *Pr. An.*, why not? Concerning the label "from the voice of" (*apo phonês*), see M. Richard, "Apo phonês," in: *Byzantion* 20 (1950), 191-222.

[21] Phil., *in Pos. An.* 424,14,24,34; Eustr., *in Pos. An.* 35,19; 238, 27; 240, 26; 241, 8.

[22] Phil., *in Pos. An.* 31, 11, 15; 49, 12, 19; 50, 8; 168, 22-23; 169, 8; 171, 1; 297, 20; 386, 31; Eustr., *in Pos. An.* 240,27.

[23] Phil., *in Pos. An.* 31, 9-11; cf. 31, 14-16.

Later, in his comment on the well-known passage in which Aristotle distinguishes knowledge of "the fact" (*to hoti*) from knowledge of "the why" (*to dioti*), Philoponus uses the language of cause and effect: "The syllogism of 'the why' infers the effect from its cause, whereas the syllogism of 'the fact' infers the cause from its effect. These latter are called tekmeriodic proofs."[24]

An example of tekmeriodic reasoning is inferring the round shape of the moon from the round shape of its visible image.[25] Another example is familiar from the *Rhetoric* commentaries: where there is now ash (the effect), there once was fire (the cause).[26]

Since Philoponus (a Platonist) holds that universals are prior to particulars, for him reasoning from particulars to universals is a form of reasoning from posteriors to priors. This allows him to count Aristotelian induction (*epagogê*) as a form of tekmeriodic reasoning: "The tekmeriodic proof establishes the things which are prior [according to nature] from those which are posterior. Of this sort is proof by induction, which establishes universals (*ta katholou*) on the basis of particulars (*ta kata meros*), that is, priors on the basis of posteriors."[27]

The commentators' theory of tekmeriodic proof is powerful and convenient. It covers in a unified way four Aristotelian doctrines: (1) the distinction between what is prior by nature and what is prior relative to us; (2) the distinction between what is better known by nature[28] and what is better known by us; (3) the distinction between proving the fact, and proving the why; and (4) induction. It seems to provide (at least a framework for) a general theory of our knowledge of principles and causes. And this is after all Aristotle's announced topic in *Physics* 1,1.

That this theory had its origins in Aristotle's remarks in the *Rhetoric* is proved by the phrase "a form of proof that is tekmeriodic and irrefutable (*alutos*)."[29] But unfortunately, this theory is a commentator's invention—or innovation—and is not a plausible interpretation of *Physics* 1,1.

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[24] Ibid., 168, 22-23.

[25] Ibid., 31, 17ff; 49, 8; 169, 2.

[26] Ibid., 169, 2ff.

[27] Ibid., 49, 19-21, and compare Ammonius, *in Pr. An.* 7, 14.

[28] Philoponus has a special view of this, according to which nature is the knower. See Phil., *in Pos. An.* 424, 7-8; *in Phys.* 12.19, and Fritsche (as note 1), 175ff.

[29] Phil., *in Pos An.* 31, 11; 49, 6; 169, 7.

The clearest case is that of induction. In the *Rhetoric*, Aristotle contrasts the tekmeriodic enthymeme with enthymemes based on induction, just because inductive reasoning is not "irrefutable".[30] Furthermore, since Aristotle holds that universals are posterior in nature to particulars, he would not agree that "tekmeriodic proof"—from posteriors to priors—could cover reasoning from particular to general.

What permits Philoponus to include induction as a variety of tekmeriodic proof is his Neoplatonic belief that universals are prior to particulars. Furthermore, since universals are in a way *causes* of what fall under them, namely formal causes (see the *Phaedo*), Philoponus would be entitled to claim that inductive reasoning is a form of reasoning from effect to cause.

However, the main reason that the commentators' theory of tekmeriodic proof is un-Aristotelian is this: Philoponus' account counts any form of reasoning from posteriors to priors, or from effect to cause, as a tekmeriodic proof. He also says that tekmeriodic proofs are irrefutable, *alutos*. But many cases, and most of the scientifically interesting cases, of reasoning from effect to cause are merely probable, in Aristotle's sense, and not irrefutable. The roundness of the moon's image may be due to the roundness of its shape, but it may also be due to a round hole in a larger body which masks it. The latter, more complicated hypothesis may be less plausible than the simpler hypothesis that the moon is round. But it would take quite a lot of work to rule out the more complicated hypothesis. In general, the problem is that most scientific reasoning from effect to cause relies on auxiliary assumptions which are, in Aristotle's sense, merely probable.[31]

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[30] *Rhet.* 2.25. 1402b13-19.

[31] This point was, in effect, seen long ago in a late ancient grammatical text: "We say that, of proofs, some are physical and others tekmeriodic. Physical proofs are e.g. when someone seeing smoke in a house recognizes that there is fire there. Tekmeriodic proofs, on the other hand, are e.g. when someone seeing a blackened area somewhere, should say that there was fire there—which is not always true" (Sophronius, *Excerpta ex Joannis Characis Commentaria in Theodosii Alexandrini Canones,* ed. A. Hilgard, in *Grammatici Graeci, Pars Quarta*, Leipzig 1894, 430, 25-28). Presumably, the quoted passage was written by Joannes Corax (whom Sophronius excerpts), a younger contemporary of Philoponus who knew and cited Philoponus' works. This text is therefore slim but tantalizing evidence of the theory of tekmeriodic proof migrating early from philosophical to grammatical theory, through the mediation of John Philoponus who worked on both. It is also evidence of early disagreement about the theory.

The new theory of tekmeriodic proof is narrower than the theory of tekmeriodic enthymeme in the *Rhetoric*, because in cases where the cause and effect are convertible, only the inference from effect to cause is a tekmeriodic proof, whereas the tekmeriodic enthymeme can run in either direction. The reason for the change is that in this new theoretical context, the place of the syllogism in the other direction, from cause to effect, is taken up by scientific proof. Like the enthymeme of the *Rhetoric,* the syllogism from effect to cause is non-scientific, and this gives our theorists room to call this syllogism also "tekmeriodic".

From an Aristotelian point of view, it is misleading to call syllogisms from effect to cause "proofs" (*apodeixeis*), both because they are not scientific and because they are normally not certain. However, the exponents of the theory of tekmeriodic proof can be forgiven their use of the term, since it has a basis in Aristotle.[32] In the *Posterior Analytics* 1, 13 Aristotle uses the term *apodeixis* both of syllogisms which demonstrate the fact, and those which demonstrate the reasoned fact. And in I, 24-28, Aristotle again uses the term *apodeixis* of partial demonstrations that in fact are not genuine, complete proofs.

As we saw, Aristotle's examples of tekmeriodic syllogisms include both causal and non-causal examples. But even in the causal examples, Aristotle's tekmeriodic syllogism requires that the general causal law, that A is a sign of B, be already known. To conclude that this ash was caused by a fire, one first needs to know both that this is ash and that ash is a sign of—is produced only by—fire. Thus an Aristotelian tekmeriodic syllogism has only a limited usefulness in establishing causes from effects. It can establish that a particular effect X results from some particular cause Y, but it can do so only if some general statement linking X with Y is already known. This general statement itself (e.g. that ash is produced only by fire) cannot be established by a tekmeriodic syllogism, unless this general statement is itself a consequence of a still more general statement which itself is already known.

The more general statement may be causal, but it need not be. All that one needs to know for this purpose is the existence of a reliable constant conjunction. One need not know the causal mechanism which connects X with Y in order to reason tekmeriodically.

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[32] Moreoever Philoponus vacillates on whether to call this syllogism an *apodeixis*: see *in Pos. An.* 26, 13-15

Thus, genuine Aristotelian tekmeriodic syllogisms can be found in science, but only in limited contexts. Cosmology is one such context. It helps that cosmology is concerned with individuals: *the* sun, *the* moon.[33] In its primary focus on particulars, cosmology is more similar to rhetoric than it is to biology or to general physics. Furthermore, much cosmological reasoning involves the application of some other science. Inferring the shape of the moon from the shape of its image is (in effect) applied optics, which itself is applied mathematics.

But whenever one's object is to establish the fundamental principles of a basic science, no Aristotelian tekmeriodic syllogism is possible. For in such cases there will not be any more general, antecedently known statement of the form "A is a necessary sign of B" from which they can be derived.

2.2 Commentaries on the *Physics*

With the theory of tekmeriodic proof in hand, we are now in a position to return to the texts commenting on *Physics* 1.1. Aristotle ends the first sentence of the *Physics* with the words: "in the science of nature too our first task will be to try to determine what relates to its principles."[34] Both Philoponus and Simplicius interpret the vague phrase "determine what relates to its principles" as meaning "determine what its principles are and what they are like." On this interpretation, Aristotle's next sentence presents his view of how physics obtains this grasp of its principles: "The natural way of doing this is to start with the things which are more knowable and clear to us and proceed towards those which are clearer and more knowable by nature."[35]

In their commentary on this sentence, Philoponus and Simplicius both ask the question, "What sort of grasp does the physicist have of the principles of physics?"[36] and they give the same answer: The physicist grasps the principles of physical things via tekmeriodic proof.[37] Remember that the function of a proof (*apodeixis*) is to convince someone, by means of a syllogism, that the conclusion is true. A tekmeriodic proof is a proof reasoning from effect to cause, or from "principled" to principle. Thus, Philoponus and Simplicius both put forward, on Aristotle's behalf, the view that the natural way for a physicist to grasp the principles and causes of physical things is to infer them syllogistically from their effects.[38]

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[33] Cf. *Met.* Z 15 and *Pos. An.* I, 8. The status of *De Caelo* as a scientific work is obviously also relevant here.

[34] *Physics* 1,1 184b14-16.

[35] *Physics* 1,1 184b16-18.

[36] Phil., *in Phys.* 9, 11; Simpl., *in Phys.* 18, 24-25.

[37] Phil., *in Phys.* 9, 15-17; Simpl., *in Phys.* 18, 28-29; see also 15, 19-25.

Philoponus call the tekmeriodic proof a "didactic" proof,[39] thereby stressing the use of the tekmeriodic proof in teaching physics. Whereas the teacher has a solid grasp of the cause, and is convinced of the effect because he is aware that it follows necessarily from the cause, the pupil, by contrast, may be only familiar with the effect, so that the way to teach the pupil the cause is to prove to the pupil that it follows necessarily from the effect.

This distinction, between the teacher's point of view and the student's, has important consequences for a field at the boundary between physics and first philosophy, namely cosmology. Simplicius' use of the argument from design as an example of a tekmeriodic proof brings out the point. When we argue from the nobility (*to kalon einai*) of the cosmos to the conclusion that God is good, he says, we reason tekmeriodically. But when we argue that the cosmos must be noble because God is good, we reason apodeictically.[40] What this example shows is that in this scheme physicists establish at least some metaphysical facts by reasoning tekmeriodically; whereas metaphysicians are able to establish at least some fundamental principles of physics by reasoning apodeictically from higher principles which physics itself is not able to independently establish.

Simplicius stresses the didactic use of tekmeriodic proof less than Philoponus does.[41] Simplicius clearly believes that tekmeriodic proof is not only a way for someone who already knows the principles of physics to teach them to others; it is also the natural way for physicists to discover the principles of physics themselves.

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[38] Although they agree in this, they disagree in other aspects of their interpretation of this passage. For a survey, see Fritsche (as note 1), chaps. 2, 3, and 6.

[39] *in Phys.* 9, 15.

[40] Cf. *Timaeus*, 27d5-29d3.

[41] See the passing reference to it at *in Phys.* 14, 32.

Simplicius, like Eustratius in his commentary on the *Posterior Analytics*, stresses that tekmeriodic proof gives one a grasp (*gnôsis*) of the principles, without giving one scientific knowledge (*epistêmê*) of them.[42] By contrast, Philoponus calls apodeictic and tekmeriodic proofs both *epistêmonikê gnôsis*.[43]

In putting forward the tekmeriodic proof as *the method* by which the physicist comes to grasp the principles of physics, Philoponus and Simplicius make a very strong claim. Recall the objections stated earlier. Aristotle recognizes other ways by which what is initially unclear to us becomes clearer. Induction is a prime example. Could not one of the ways that the physicist arrives at his principles be via induction? (As we saw, Philoponus—mistakenly—counts induction as a kind of tekmeriodic proof.)

Tekmeriodic proof requires that all the concepts involved in the syllogism be clear and well-established; and the universal major premise must also be established in advance. How difficult it is to fulfill these requirements depends on what one counts as "the principles" of physics, a complicated topic about which the ancient commentators disagree, and which I aim to avoid here. But it is clear enough that many of the most interesting and important "principles" of physics—that change is between opposites; or the four causes; or (if the principles sought are principles of particulars) that this giraffe has a long neck in order that it may eat tree-leaves—do not satisfy these requirements.

Simplicius has an argument that the physicist's method of grasping principles must be tekmeriodic proof. The argument runs:[44] (1) Everything known (*gignôskomenon*) is either self-evident or derived. (2) The principles of physics are not self-evident, so (3) they must be derived. (4) All derived knowledge—i.e. all discursive (*dianoetikê*) teaching and learning—is syllogistic and apodeictic. (5) Knowledge of the principles of physics is syllogistic and apodeictic. (6) There are two kinds of syllogistic knowledge, true or proper apodeixis and tekmeriodic apodeixis. (7) Knowledge of principles (as contrasted with knowledge *from* principles) is tekmeriodic (rather than apodeictic). Therefore (8) the physicist's knowledge of the principles of physics is tekmeriodic.[45]

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[42] Eustr., *in Pos. An.* 239, 5-7. Simpl., *in Phys.* 16, 5. Compare the knowledge of physical principles the metaphysician is said to have at 15, 29-16, 2.

[43] *in Phys.* 9, 12.

[44] The argument draws loosely on various statements in the *Posterior Analytics*, e.g. 71a1 and 72b19-24.

The flaw in this argument is step (4). According to Aristotle, induction, analogy, and probable reasoning[46] are three important routes to knowledge (*gnôsis*) of principles which are left out of the list in this step. Even if Aristotle does think that some cases of induction can be organized syllogistically,[47] surely not of them can. Although Simplicius himself might want to defend them, Step (4) and its consequence step (5) are therefore both un-Aristotelian.

2.3 Source of the theory in Ammonius

In the preceding sections, we have seen how what began in Aristotle as a comparatively innocent distinction between certain types of rhetorical syllogism is transformed, in Philoponus and Simplicius, into a universal theory of how physicists establish the principles of their science.

Philoponus' and Simplicius' conception of tekmeriodic proof was clearly not invented by them. They refer to it as an established usage.[48] Furthermore, they employ the concept in applied scientific contexts in a way that would be surprising for a newly-minted methodological concept.[49] That the notion of tekmeriodic proof was a well-established tool in the philosopher's standard toolkit is shown by Damascius' employment of it in his commentaries on Plato.[50]

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[45] *in Phys.* 15, 1-25.

[46] I am assuming here that part of what it means to call something a tekmeriodic proof is to say that it is irrefutable (*alutos*) and not merely probable. Although the tekmeriodic proof is called *alutos* in the *Posterior Analytics* commentaries, it is not explicitly called *alutos* in the *Physics* commentaries.

[47] E.g. when generalizing about a genus from an exhaustive examination of its proximate species (*An. Post.* 1.5; *An Pr.* 2.23).

[48] Phil., *in Pos. An.* 31,11,16; 49,12; 50,7; 168, 22; 169, 7; 297,20; *in Phys.* 9, 17. Unlike Philoponus, Simplicius does not use words like *kaleitai*, but he also treats it as settled doctrine: *in Phys.* 15, 24; 18, 28.

[49] Phil., *in de An.* 30, 20; 31, 15; Simpl., *in Cael.* 258, 7; 263, 34. Interestingly, Simplicius misinterprets Aristotle's term *tekmêrion* at *de Caelo* 277a27 as meaning *tekmêrion* in the strict sense of tekmeriodic proof. On this see also Simpl., *in Phys.* 9, 23.

[50] *Treatise on First Principles,* Ruelle I 266, 29 (=Westerink III 78, 11), where the context is Neoplatonic theology; *In Phaed.* I 216, 3; and *in Phileb.* 68, 1. Damascius' statement at *In Phaed.* I 216, 3 is a little puzzling. The term

The obvious conclusion to draw is that Philoponus, Simplicius, and Damascius all received the notion of the tekmeriodic proof from a common source, their teacher Ammonius. Although the concept does not appear in any of Ammonius' extant commentaries, this fact does not undermine the conclusion, given how few of Ammonius' commentaries survived.[51]

In all probability, the tekmeriodic proof was taught by Ammonius as an established philosophical technique. Whether Ammonius went so far as to claim that this technique is the universal method of establishing principles of physics is less secure. But on the principle that where two commentators agree, they are probably passing on inherited opinion, the fact that Philoponus and Simplicius agree on this point suggests that Ammonius, their teacher, had already developed the doctrine of tekmeriodic syllogism that far.

3 Tekmeriodic proof and the Renaissance *regressus*

Among the most important theories of method in physics which have been "read back" into the passage with which this essay began is the 16th century theory of *regressus*. From the perspective of a philosopher and commentator like Zabarella, the process of "distinguishing" (*diairousin*, 184a23) through which Aristotle declares in *Physics* 1.1 that we come to know the elements and principles of physical things is simply *resolutio*, the first and upward part of the method of *regressus*. Thus the history of commentary on the beginning of Aristotle's *Physics* is a useful place to

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"*tekmêrion*" must be used there in the sense of "probable sign," i.e. as equivalent to the homonymous semeion of Aristotle's *Rhetoric*. According to Damascius, Harpocratio interpreted Socrates' argument from opposites in the *Phaedo* as an argument "from a sign" (Dam., *in Phaed.* 182=Harpocratio, frag. 6 Dillon). This passage occurs within the "monograph" that was presumably written by Damascius himself. (See Westerink in *The Greek Commentaries on Plato's Phaedo II: Damascius,* 1977, 16.)

Another aberrant use of the term tekmêriôdês, from the same philosophical circle, occurs at Anon., *Proleg.* 27. 29 Westerink. There, Plato's reliance on universal agreement as a basis for his argument is called a "tekmeriodic" method of teaching. The idea, but significantly, not the term, appears also in Proclus, *In Alc.* 261,11-21, and Ol., *in Alc.* 92.4-5. What Simplicius and Philoponus refer to as "tekmeriodic proof" is called simply tekmêrion by Ol. at *In Meteo.* 333,38-334,5.

[51] Moreover, Ammonius' use of the term *tekmêrion* in the surviving commentaries is not the technical use associated with the tekmeriodic proof, but rather the ordinary casual use common also in Aristotle.

look, if one is interested in tracing the series of steps by which the Renaissance theory of *regressus* came into being.[52]

Moreover, the need for a detailed study of the antecedents of the *regressus* in the ancient Greek Aristotle commentators, and in later ancient Greek philosophy generally, has been remarked upon for nearly two centuries.[53] One effect of the remarkable gathering at Wolfenbüttel which gave rise to this volume has been to prompt me to undertake this project.[54] In this essay, I have presented a preliminary version of a key section of this larger study.

As I see it, the theory of tekmeriodic proof which we find in Simplicius and Philoponus is the earliest theory which deserves to be called an "early version" of the *regressus.* Of course there is little profit in disputing about a name, about what exactly counts as a "version" of the *regressus.* But the theory of tekmeriodic proof definitely marks a major advance upon earlier theories. It is the first time in the Aristotelian tradition that analysis is put forward as a general method of arriving at first principles in physics, and the first time that this method is used to unify the four Aristotelian doctrines mentioned above.[55] Analysis has a long and distinguished history as a part of Platonic dialectic. But in the theory of tekmeriodic proof, for the first time in history, this method is put forward as a general method for the discovery of principles in Aristotelian physics. This means that the theory of tekmeriodic proof is the earliest theory of method which performs the function of the *methodus resolutiva* portion of the *regressus.*

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[52] One interesting complication in the transmission of the theory of tekmeriodic proof into the Renaissance—which I am unable to discuss in detail here—is Theodosius' mistranslation of Philoponus' *tekmeriodês* as *coniecturalis.* For a brief discussion and references, see N. Jardine, "Epistemology of the Sciences," in: C. Schmitt, E. Kessler and Q. Skinner (eds.), *The Cambridge History of Renaissance Philosophy*, Cambridge 1988, 689, and P. Lautner's review of the recent reprint of Theodosius' translation in: *Ancient Philosophy* 16 (1996), 538.

[53] F. Nicolai, "Bemerkungen über den logischen Regressus, nach dem Begriffe der alten Kommentatoren des Aristoteles," in: *Philosophische Abhandlungen der königlichen Akademie der Wissenschaften zu Berlin* 1 (1808), 207; N. Jardine (as previous note), 687.

[54] The manuscript's current working title is "Conceptions of Analytic Method in Later Ancient Greek Philosophy."

[55] See 9 above.

The thesis that the theory of tekmeriodic proof is the earliest version of the *regressus* is revisionary. Historians of the Renaissance typically put the origins of the method further back. The received view can be illustrated through a recent article by the eminent Italian scholar G. Papuli.[56] Papuli traces the ancient antecedents of the *regressus* to two sources: the preface to Galen's *Ars medica* and Themistius' commentaries on Aristotle.[57] However, neither of these texts are in fact good candidates as ancient versions of the *regressus*.

The method of "analysis" mentioned in the preface to Galen's *Ars medica* is a method of organizing a treatise, or (somewhat more grandly) a method of organizing an entire body of already acquired knowledge. This method of "analysis" is quite different from the *analysis* at work in the *regressus,* which is a method of acquiring knowledge, a "logic of discovery".[58] So the Renaissance *regressus* theorists could not have derived their theories from a reading of Galen himself. You cannot get blood from a turnip; and you cannot get the *regressus* from Galen.

However it is true that the Renaissance *regressus* theorists did learn about the theory from reading "books of Galen", because medieval Galen commentators, going back to Pietro d'Abano[59] and beyond, read the theory *into* Galen, and attributed it to him in their commentaries.[60] (These medieval Galen commentators presumably acquired their understanding of the theory from Averroes, and perhaps other sources.[61]) The preface to Galen's *Ars medica* played an important role in the history of the *regressus*, not by embodying an earlier stage of the theory, but by providing a locus for creative medieval misreading.

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[56] G. Papuli, "La Theoria del *Regressus* come Metodo Scientifico negli Autori della Scuola di Padova," in: *Aristotelismo Veneto e Scienza Moderna*, L. Olivieri, Padova 1983, 221-77.

[57] Ibid., 224-5, 227-8.

[58] The importance of this distinction for interpreting Galen was stressed already by N. Leoniceno at the beginning of the 16th century (*Nicolai Leoniceni . . . de tribus doctrinis ordinatis secundum Galeni sententiam opus . . .*, Venice 1508). On Leoniceno, see W. Edwards, "Niccolò Leoniceno and the Origins of the Humanist Discussion of Method," in: E. Mahoney (ed.), *Philosophy and Humanism: Renaissance Essays in Honor of Paul Oskar Kristeller*, New York 1976, 283-305, and P.-G. Ottoson, *Scholastic Medicine and Philosophy: A Study of Commentaries on Galen's Tegni (ca. 1300-1450)*, Naples 1984.

[59] *Conciliator differentiam philosophorum, et praecipue medicorum*, Venice 1504.

[60] Though at a certain stage these later glosses get incorporated into the text itself, giving rise to justifiable confusion. See N. Jardine, "Galileo's Road to Truth and the Demonstrative Regress," in: *Studies in the History and Philosophy of Science*, 7 (1976), 285, n. 19, and the further references cited there.

The case of Themistius[62] is somewhat different. His theory of the "syllogism from the sign" is a genuine ancestor to the *regressus*. Papuli claims to find "already a sort of concise theory of *regressus*" in Themistius.[63] But in fact, Themistius' conception is much more primitive and limited than either the Renaissance *regressus*, or even the theory of tekmeriodic proof found in Philoponus and Simplicius. There is nothing in the passages Papuli cites which "could suggest the possibility of a demonstrative science which has recourse either to *demonstratio quia*, i.e. to *resolutio*, or to *demonstratio proper quid*, i.e. to *compositio*."[64]

In his commentary on *Physics* 1,1 Themistius asks, "How are we able to say anything about principles on the basis of proof (*meta apodeixeos*)?"[65] His answer is that we must proceed to what is prior by nature from what is prior to us. In this way our proof is "from what is prior", even though not in the sense required for a proper apodeixis. We reverse the normal order (*anapalin de hê poreia*) by analyzing (*analuomen*) compounds into their simpler elements which are prior by nature.[66] He contrasts proper (*kuriôs*) apodeixis with this new sort, which he calls "apodeixis sufficient for our purposes" (*hê apodeixis hêmin hikanôs*).[67]

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[61] Although Arabic sources are presumably the most important for the transmission of ancient theories of analysis and tekmeriodic proof to the Latin West, lines of transmission through Byzantium would also be worth investigating. For example, it is clear that the theory of tekmeriodic proof was given some attention in the school of Joannes Italos. See Isaac Comnenius Sebastocrator, *De La Providence et de la Nécessité Physique*, chaps. 52-53 (in: Proclus, *Trois Études sur la Providence*, ed. D. Isaac, Paris 1977-82, and also in M. Erler (ed.) *Über Vorsehung und Schicksal*, Meisenheim am Glan 1979). Some further Byzantine references: Joannes Pediasimus, *In Aristotelis Analytica Scholia Selecta*, ed. V. de Falco, Naples 1926, 93 (*Ad Pr. An.* 72a7); Eustratius, *In NE*, 32,4; 75, 24; 282,36, and *In Pos. An.* (as notes 21, 22, and 42 above); Anon., *in Pos. An. I* (CAG XXI), xviii,19; Sophonias, *In de An.* 7, 8; and Eustathius, *In Od.* 42, 12.

[62] For a general account of Themistius, see H. J. Blumenthal, "Themistius, the last Peripatetic commentator on Aristotle?" in: R. Sorabji (ed.) *Aristotle Transformed: The Ancient Commentators and their Influence*, Ithaca 1990, 113-24.

[63] Papuli (as note 4), 228.

[64] Ibid., 227.

[65] Them., *in Phys.*, 1, 11.

[66] Ibid., 1, 18-19.

Themistius says nothing about the apodeixis from what is prior to us being an inference from effect to cause. Nor do his remarks imply the idea of a general method by which the principles of physics can be proved. Themistius' question is: how is it possible for us to say anything provable about the principles of physics? And his answer, strictly speaking, implies only that *there are* cases in which we can reason syllogistically to principles of nature from what is prior to us, not that *in general* or *in all* cases we can.

Themistius' account of the "syllogism from signs" is found in his commentary (*periphrasis*) to Aristotle's *Posterior Analytics* I, 13. Since Themistius speaks of "the syllogism from the sign" (*ho dia tou sêmeiou syllogismos*),[68] in his commentary on ths same passage where Philoponus speaks of "tekmeriodic" syllogism, one may reasonably infer that Themistius' theory of the syllogism from signs is an ancestor to the later theory.

However, Themistius' account of the syllogism from signs differs from Philoponus' and Simplicius' theory in several respects that are philosophically crucial. First, whereas "tekmeriodic syllogisms" include any syllogisms from posteriors to priors, whether unmediated or mediated, Themistius includes only immediate syllogisms as "syllogisms from signs".

The second way in which Themistius' theory of the syllogism from signs differs from the later theory of Philoponus is that Themistius does not employ the notion of "syllogism from signs" in his account of induction. His paraphrase of Aristotle's account of induction in *Posterior Analytics* II X is a fairly orthodox one, according to which *nous* is the cause of our knowledge of universals, operating on the materials antecendently given to it by perception (*In Pos. An.* 64-66). Themistius' difference from Philoponus on this point is clear evidence that his work pre-dates the neo-Platonic impulse which produced the theory of the tekmeriodic syllogism.

Both Themistius' opposition to the idea that we can come to know the ultimate principles of demonstration through demonstration, and his appeal to self-evidence and *nous* are plain and simple *periphrasis* of Aristotle, and hence plain Aristotelian orthodoxy. His remarks are very far from giving the syllogism from signs any substantive role whatever in the acquisition of scientific knowledge. [69]

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[67] Ibid., 2, 3.

[68] Them., *in Pos. An.* 28,16 - 29,3. See also 6,18; 17,20; and 37,10-11.

Neither Themistius nor Galen, then, are plausible candidates for having put forward an early version of the *regressus*. Suppose that it were established (which would take a much longer argument than I can give here) that no theory earlier than the theory of tekmeriodic proof deserves to be called an "early version" of the *regressus*. Even so, some historians of Renaissance theories of method might wish to dispute my claim from the other direction, by arguing that the theory of tekmeriodic is not enough like the *regressus* to deserve the description "an early version" of the theory. That title belongs instead to someone later, perhaps to Averroes.

Two arguments might be given. The first is that neither Philoponus nor Simplicius include in their theories of method the intermediate stage of mental processing between analysis and synthesis that later became known as *negotio*. The *negotio* is an essential part of the method of *regressus*. Thus where there is no *negotio*, there is no *regressus*.

Here again, it is important not to get bogged down quibbling about names. And it is true that as long ago as Nicolai's essay,[70] the *negotio* was seen as a central and defining feature of the *regressus*. But I believe that this way of conceptualizing the matter is somewhat misleading. It obscures the philosophical dynamic. What is philosophically fundamental is the conception of a general method of discovery and proof. This we have already in Philoponus and Simplicius, with their theories of tekmeriodic and apodeictic proof. However, this method faces an objection with good Aristotelian credentials: namely, that it is circular. The doctrine of *negotio* was developed in order to overcome an objection to the basic theory of method. This doctrine was so difficult and subtle, and the objection to which it responds so central, that the doctrine of *negotio* came to be seen by some, perhaps, as the most interesting part of the theory. But the philosophical dynamic was this: first basic theory of method; then the objection; and then the doctrine of *negotio* in response to the objection. What we find in Philoponus and Simplicius is just the first stage: when the basic theory of method had been developed, but the need to respond to the objection of circularity had not yet been clearly felt.

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[69] He comes closest in *in Pos. An.* 43,25-29.

[70] As note 53.

The second objection is this: the term *regressus* came to stand for both parts of the method taken together; that is, both analysis and synthesis, both the road up and the road down. Similarly, the term *demonstratio potissima* combined both demonstration upwards and demonstration downwards under a single concept. Neither Philoponus nor Simplicius employs a single term to refer to both parts of the method together. Therefore, so runs the objection, while they may have theories of both parts of the method, taken separately, they do not have a theory of the two methods taken together, that is, a theory of the single unified method, the *regressus*.

This objection, like the previous one, seems to me to mistake what is philosophically fundamental. What counts is putting forward general methods of discovery and proof in physics. These Philoponus and Simplicius both have, in the basically the same form as the Renaissance *regressus*. (I have concentrated on their theories of upward method, or tekmeriodic proof, in this essay, because the downward method, apodeictic proof, was common property in later Greek philosophy.) To move from a conception of two methods, tekmeriodic proof and apodeictic proof, to a conception of a single method, *demonstratio potissima,* which combines them both, does perhaps mark an increase in the maturity of the theory and the degree of concious awareness with which it is held. But so far as I can see, it is fundamentally just a change in label, and brings with it no philosophical advance or change whatsoever.[71]

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[71] Thanks are due to many people and institutions for their encouragement and assistance of my work on this essay; above all, to the persons and institutions responsible for the seminar which gave rise to this volume, and to my fellow participants there. Thanks also to the Cornell University Department of Classics for its hospitality while I wrote the first version of this essay, and to the Alexander von Humboldt Foundation and the Center for Hellenic Studies for their support during the time that I made various revisions to it. J. Lennox, R. Sorabji, and P. Lautner provided useful comments, as did two anonymous referees. Special thanks are due to N. Jardine for his vigorous criticisms following a presentation of this paper at Cambridge, to which I hope I have provided at least a partial response.

EL “REALISMO” DE PRINCIPIOS DEL S. XII Y EL “ECLECTICISMO” PLATÓNICO-ARISTOTÉLICO: SOBRE LOS UNIVERSALES Y LA TEORÍA DE LA *INDIFFERENTIA*

Pedro Mantas

Las sesiones del Seminario de Wolfenbüttel me brindaron una magnífica ocasión para, entre otras actividades más específicas, ayudarme a reflexionar sobre un problema que responde a alguna de las cuestiones suscitadas en dicho Encuentro y que, desde mi punto de vista, constituye una de las enseñanzas a extraer de aquellas jornadas. El problema, a un nivel muy general, puede explicarse como una cuestión de tipo histórico que se interroga por uno de las grandes asuntos inherentes a la historia intelectual: el problema de la tradición, su articulación y los procesos de eclecticismo que, en su recuperación, aparecen como una constante a lo largo de la historia de la filosofía. Más precisamente, el asunto tiene que ver con los intentos de un tradición filosófica que se debate en interpretar algunos de los intentos de “síntesis” del pensamiento de los grandes maestros, en este caso, de Platón y Aristóteles.

La primera evidencia que podemos reunir en torno al problema se deriva de una dificultad: poder captar y explicitar la tradición en la que, de modo implícito, situamos nuestras afirmaciones sobre la realidad; la segunda: el esfuerzo de “apertura” que conlleva aceptar los presupuestos “ideales” de todo pensamiento como parte de una cosmovisión a la que ningún pensamiento puede renunciar – aunque ello suponga la ardua tarea de fundamentación en la que muchas filosofías han encontrado su límite insalvable.

Atendiendo al las distintas intervenciones del Prof. Wallace en el Seminario y extrayendo algunas conclusiones sobre la formación filosófica del joven Galileo, no fueron pocos los interrogantes que sus palabras me suscitaron a cerca del problema de la presencia y el modo de operar de la tradición en los procesos de la evolución intelectual. Alguno de estos interrogantes me indujeron (referencial y metodológicamente) a reflexionar sobre el problema de la transición del pensamiento medieval a la filosofía y ciencia del Renacimiento, desde la perspectiva de un tema que en la actualidad ocupa mi atención.

1 El "realismo" y la teoria de la *indifferentia*

Es claro que, conjugado de un modo u otro, el "realismo" presente en la valiosa transición que arranca a partir de los últimos decenios del siglo once – como preámbulo e inicio de la irrupción de una época conocida como "Renacimiento del siglo doce", no puede despacharse sin más con apelaciones al "realismo" aristotélico, el pensamiento "platonizante" y otros calificativos de este tipo, sin matizar o explorar el origen y el sentido de estas denominaciones. Teniendo muy presente esta consideración y, precisamente, interesado en reflexionar sobre el "realismo" de Anselmo de Canterbury, de Guillermo de Champeaux y algunos de sus contemporáneos, en conexión con el problema de los universales y su relación con el emergente "vocalismo" del s. XI y el nominalismo del s. XII, he dedicado algún tiempo al estudio de ciertas "teorías de la *indifferentia*", así como el sentido de la *indifferentia* en Guillermo de Champeaux y la que presenta el *De eodem et diverso* de Adelardo de Bath.

Bien es cierto que aunque estos problemas han sido tratados por activa y por pasiva durante muchos años, llegando un momento en que la erudición medievalista había desembocado en un cierto "escolasticismo" y donde parecía que nada nuevo podía añadirse al asunto, en los últimos decenios asistimos al resurgir del estudio de la Edad Media y el interés por recordar la necesidad, a todas luces irrenunciable, de continuar esclareciendo las líneas de pensamiento que se conjugan en la lectura medieval del pasado, su conexión con el pensamiento del catorce y el surgimiento del Renacimiento de los siglos quince y dieciséis. En cualquier caso, no se pretende aquí sino una labor de comentario, tratando de reflejar el contenido de algunas de las líneas de la investigación actual en torno a estas temáticas y algunas de las preguntas que de ellas se derivan, tomando como referencia aportaciones recientes, que son un buen reflejo del modo como en la actualidad se sigue proyectando el resurgir y nuevo impulso en el debate sobre la Edad Media.[1]

Para llegar a responder a la pregunta sobre "qué supone y cómo se llega a la teoría de la *indifferentia* dentro del conjunto de reflexiones sobre el problema de los universales," necesitamos repasar algunos conceptos que puedan aclarar los términos a que nos referimos cuando hablamos de "realismo" en el contexto del doce.

Puede decirse que hasta el siglo once los comentarios sobre la *Isagoge* de Porfirio están escritos en dependencia directa de los "comentarios" de Boecio, pero algunos de ellos se caracterizan por incluir pasajes que no siguen a Boecio. Los primeros que pueden citarse, aparte de los que se consideran fragmentarios, son:

El "comentario" del Pseudo-Rabano que se encuentra en los manuscritos Ms. Oxford, Bodleian Library. lat. 67, fols. 9v-14v (ca. 1160-1170), Ms. Assisi 573, fols. 4r-15v; Ms. Paris Bibl. Nat. lat. 13368, fols. 215r-223r, Ms. Dublin, Trinity Col., E.5.7. (452), no foliado; el "comentario" que se encuentra en el Ms. München, Bayerische Staatsbibliothek clm 14458, fols. 83r-93r (s. XI) y el "comentario" del Ms. Paris Bibl. Nat. lat. 17813, fols. 1r-16v (1ª década del s. XII).

En este último comentario (escrito por Guillermo de Champeaux o alguno de sus discípulos) y, en general, en los escritos de los "vocalistas", puede advertirse que las "introducciones" a Porfirio no incluyen preliminares donde se enumeren detalladamente los desarrollos que habían provocado las preguntas formuladas por Porfirio. Quiere decirse entonces que, hasta que no aparecen los *Logica Ingredientibus* de Pedro Abelardo, la disputa sobre los universales ni se ve reflejada explícitamente ni se desarrolla en "comentarios introductorios" a Porfirio.

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[1] En lo que se refiere al estudio de algunas fuentes del once y doce para la investigación sobre el "realismo" de transición entre estos siglos, así como lo orígenes del "vocalismo" y el nominalismo, son muchos los investigadores a destacar, aunque, para la realización del presente artículo, me han servido de guía algunos artículos y comentarios aclaratorios de Yukio Iwakuma y William Courtenay, así como el magisterio de Charles Burnett: Y. Iwakuma, "Twelfth Century *Nominales* and Peter Abelard, *Nominalia inedita* and other relevant sources," en: *Vivarium* 30-1 (1992), 97-109; idem, "*Vocales*, or early nominalists," en: *Traditio* 47 (1992), 37-111; idem, "William of Champeaux and the *Introductiones*," en: H. A. G. Braakhaus y C. G. Kneepkens (eds.), *Actas del "10th Symposium on Medieval Logic and Semantics"*, en prensa; idem, "The Realism of Anselm and his Contemporaries," en: D. E. Luscombe y G. R. Evans (eds.), *Anselm: Aosta, Bec and Caterbury*, Sheffield 1996, 120-32; Y. Iwakuma y S. Ebbesen, "Logico-theological schools from the second half of the 12th. Century. A list of sources," en: *Vivarium* 30-1 (1992), 173-210; W. J. Courtenay, "*Nominales* and *Nominalism* in the 12th Century," en: J. Jolivet, Z. Kaluza y A. De Libera (eds.), *Hommage a Paul Vignaux* (Études de philosophie médiévale 65), Paris 1991, 11-29; véase también su "Introduction" a las comunicaciones del coloquio sobre nominalismo del siglo doce, Madison, (Wis.) Oct. 3-5, 1991 y, en general el conjunto de las actas de la Conferencia de Madison publicadas en *Vivarium* 30-1 (1992).

De los tres citados anteriormente, el más influyente en la cuestión de los universales no es el de Guillermo de Champeaux, sino el primero de los enumerados, el de Pseudo-Rabano: un texto muy frecuentado durante el doce, con una terminología y un desarrollo teórico independiente del utilizado por Anselmo de Canterbury.

Según su autor, los universales, en cierto sentido, nada son, pues sólo existen los individuos (el autor pretende tal afirmación derivándola de las tesis de Boecio) aunque, en otro sentido, los universales y los individuos son una misma cosa, los universales no existen en los individuos como algo distinto.[2] Pues bien, puede pensarse –y así lo hace Iwakuma[3]– que al afirmar ésto, se incurre en contradicción; sin embargo, como veremos más adelante, la contradicción sólo sería el producto de una lectura del argumento algo precipitada: en la tradición aristotélica, una especie está constituida por un género y las diferencias, un individuo, por una especie y los accidentes que corresponden a dicho individuo. El género es la materia de la especie y la especie la materia del individuo; del mismo modo, las diferencias son las formas de las especies y los accidentes las formas de los individuos. Ahora bien, según parece esta identificación se hizo popular a partir de su formulación por parte del Ps. Rabanus porque, ciertamente, ni se encuentra en la *Isagoge* de Porfirio ni en la obra de Anselmo.

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[2] "Itaque genera et species inquantum sunt universalia nihil dicuntur esse, quia nusquam pura inveniuntur. Nulla enim essentialiter existunt nisi sola individua." (Ms. Oxford, fol. 10ra). "Hic innuit Boethius quod eadem res est individuum et species et genus, non esse universalia in individuis quasi quoddam diversum, ut quidam dicunt, sed speciem nihil aliud esse quam genus formatum, et individuum nihil aliud esse quam speciem formatam. Aliter autem non diceretur universalitas et singularitas eidem subiecto accidere." (Ms. Oxford, fol. 10ra).

[3] Iwakuma, "Realism" (cit. n. 1), 121-122: "These two ideas, however, are not compatible well with each other. What is the same thing that is individual and universal at the same time? Seeing that the next sentence 'universals do not exist in individuals as something different', and the first idea, viz. 'nothing actually exists except individuals', the 'same thing' appears to mean individuals. But if so, then the following problem occurs. The species *homo* in Socrates is the same thing as the individual Socrates, and the species *homo* in Plato is the same thing as the individual Plato. Then, since Socrates and Plato are different things, the species *homo* in Socrates and that in Plato cannot be the same thing. It concludes then that Socrates and Plato do not belong to the same species *homo*. However, Ps-Rabanus himself does not notice yet the problem at all. He has no hesitations in asserting the traditional view that different individuals, Socrates and Plato, have the same species *homo*."

Anselmo se había concentrado en un tratamiento de los universales que dejase el camino expedito a cuestiones teológicas que tenían que ver con la unidad de sentido que el universal puede aportar, asumiendo el "realismo extremo" de quien afirma la existencia del universal independientemente de las cosas. ¿Se trata de un "realismo platónico"? Iwakuma piensa que Anselmo no dice nada nuevo con respecto a lo afirmado por Porfirio y Boecio, pues, aparte de asumir que en el mundo de la percepción corpórea lo que existen son los individuos[4] y es en el terreno de lo inteligible donde se llega al universal; en la línea de Boecio, Anselmo se aparta de la concepción platónica tradicional sobre la existencia de un mundo distinto del mundo sensible,[5] a saber, que la intelección del universal, además de suponer el acto mental de llegar a su comprensión, lo presupone dentro del ámbito del mundo sensible desde el que se elabora el proceso de intelección. Anselmo asume, también con Boecio, que los universales son naturalezas comunes a los individuos, tomando de Porfirio la idea de que una naturaleza humana común adviene varios seres humanos individuales a causa de la *proprietatum collectio.*

El Pseudo-Rabano parecía contradecirse en aquellas afirmaciones que le hacían postular, al mismo tiempo, la sola existencia del individual junto a la afirmación de que el universal y el individuo son una misma cosa. Por su parte, Anselmo parece desembocar en una posición que, en principio y considerada *grosso modo*, tampoco ofrece argumentos evidentes y precisos sobre el modo como explicar la relación entre el universal y lo individual.

Sin embargo, para Anselmo, el término *essentia* encierra un doble sentido. Como es sabido, la palabra *essentia*, junto con el verbo *esse* de la que se deriva, fue, al menos durante una buena parte de la Edad Media, motivo de controversia y elemento aglutinador de muy distintos modos de reflexionar a cerca de la relación ser-existencia, y sobre la constitución de lo real; de hecho, y como derivación de estas controversias y algunas de las tesis que de ellas pueden extraerse, así como de los principios por ellas esgrimidos, ciertos argumentos se mantienen en debate hasta muy entrado el período de la filosofía moderna.

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[4] *Epistola de incarnatione Verbi*, I, 9.20-10.13, *S. Anselmi Cantuariensis Archiepiscopi Opera Omnia*, ed. F. S. Schmitt, 6 vols., Stuttgart-Bad Cannstatt 1938-1961, vol. 2 (^{2}1968); cfr. Iwakuma, "Realism" (cit. n. 1), 123, n. 8.

[5] *Monologion* 30, in *S. Anselmi Cantuariensis Archiepiscopi Opera Omnia* (cit. n. 4), I, 49.24-50.1.

Hasta una época algo posterior a Anselmo, *essentia* no se entiende en otro sentido que el derivado de su signficado de "ser" y "existencia". Ahora bien, en Anselmo se acogen los dos significados que posteriormente se otorgan al término, y si bien no quedan conscientemente explicitados por él, si están implícitos en su modo de argumentar, aunque es cierto que en Anselmo todavía encontramos un uso unívoco de *essentia* que hasta más tarde no atiende a la función copulativa, correspondiente al significado del *esse* entendido como "ser o existir en tanto que algo", y sin embargo es éste el sentido con el que Anselmo emplea la expresión *essentialiter*, usando el sentido aristotélico de "substancia primera". Por tanto, en el razonamiento anselmiano, la distinción queda patentizada implícitamemte a partir de su distinción entre la *essentia* referida a las criaturas y la *essentia* referida a Dios, aunque esta diferenciación no sea asumida de manera expresa.

Para Anselmo, sólo Dios existe absolutamente, las criaturas no son propiamente existentes sino que existen en tanto que son algo, y aquí Anselmo toma el sentido de *essentia* que se deriva del uso copulativo de *esse*. El universal es para él aquello que, *essentialiter*, es común a las distintas substancias de los distintos seres individuales, una *essentia* universal es siempre la misma, independientemente de que se de en distintos individuos.

Ahora bien, aunque Anselmo de Canterbury se encuentra fuertemente influido por Porfirio y Boecio, y el uso que hace de *esse* y *essentialiter* quizás pueda servir para reforzar la idea de un "aristotelismo" anselminano,[6] me pregunto si, cuando hablamos de "aristotelismo" o "platonismo", nuestro problema no será otro que una actitud inadvertida por olvidar el modo como la tradición suele operar en la formación del pensamiento, a saber, de un modo siempre más latente e inclusivo que expreso y excluyente. Pero de ello nos ocuparemos mas adelante, baste por ahora decir que en el tratamiento anselmiano de los universales, una determinada interpretación de la *essentia* sirve para concretar el problema al que aquí tratamos de responder: el modo como el universal forma parte del individual sin ser el individual mismo; cómo es posible decir que en cuanto a la existencia del universal, lo primero es el individuo, pero que el individuo y el universal mantienen una relación que en algunos casos es pensada en términos de unidad.

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[6] Iwakuma así lo piensa, cfr. "Realism" (cit n. 1), 132 y finales.

Al período sobre el que aquí tratamos también pertenece Odo de Cambrai, cuya obra puede ayudarnos a ilustrar otro modo de ofrecer una respuesta al problema de los universales, dentro de un ámbito de reflexión en el que las influencias de Porfirio, Boecio, el Pseudo-Rabano y Anselmo parecen claras.

Al comentar el problema del "pecado original", Odo desarrolla una teoría muy similar a la de Anselmo. Para aquél, el pecado original lo hemos heredado los hombres desde Adán y Eva a través de la naturaleza común a todos los hombres, corrompida por nuestros primeros antepasados. Esta naturaleza humana compartida se convierte en individual (lo mismo que para Boecio y Porfirio) en la medida en que sufre la interacción de los accidentes característicos de cada individuo.[7] Odo también sigue a Boecio en su explicación del modo como conocemos el universal cuando dice que los universales son objeto de la razón y los individuales objetos de los sentidos.[8]

La evidencia de estas infuencias llevaron a Iwakuma a plantear la difícil consistencia de una interpretación de Odo como autor de raíces platónicas, pues los cimientos originales de su pensamiento, aparte las influencias ya mencionadas, junto con los elementos que toma del Pseudo-Rabano –es decir, identificar las diferencias y los accidentes particulares en un individuo como formas de las especies y los individuos respectivamente– se basan en su divergencia respecto a algunos autores que influyen en él, pues Odo no identifica el género y la especie como la materia de las especies y los individuos; todo lo cual, no tendría por qué inducirnos a pensar, necesariamente, en un "platonismo" de Odo de Cambrai.

Entre los maestros que más influencia ejercen en la controversia sobre los universales es ineludible analizar las tesis del "realismo extremo" de Guillermo de Champeaux y las sucesivas rectificaciones que le imponen las críticas de Pedro Abelardo. En sus primeras tesis, agrupadas bajo la denominada "teoría de la esencia material", Champeaux afirma que el universal es, *essentialiter*, uno y el mismo en muchos individuos; la especie es la esencia material de los individuos que agrupa, la forma son los accidentes propios a un individuo. Por tanto, *essentialiter*, uno y el mismo género es la materia de sus especies, mientras que las diferencias son formas de las especies. Guillermo identifica lo que hay de común en el individuo –la especie y el genero– con el universal: el universal es, en sí, lo mismo y lo diferente en cuanto que, a través de las formas, se convierte en singulares.

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[7] Odo de Cambrai, *De peccato originali*, en: J. P. Migne (ed.), *Patrologia Latina* (*PL*), Paris 1853, vol. 160, 1079a-b.

[8] Ibid., *PL* 160, 1079b-c.

Tras las críticas de Abelardo, Guillermo modifica sus tesis en lo que viene a denominarse como "teoría de la *indifferentia*".[9] Interesa detenerse aquí por dos razones: primero porque su sistema de la *indifferentia* puede presentarse como un claro intento ecléctico de compatibilización de las tradiciones platónica y aristotélica, que más o menos explícita o parcialmente se reproducen en la filosofía de esta época; segundo, porque de algún modo, una de las hipótesis que pretendemos establecer (la identificación del planteamiento de Adelardo de Bath sobre los universales por referencia al contexto de los autores a que nos estamos refiriendo) podría estar relacionada con las tesis de Guillermo, si bien, y como apunto más adelante, la "indiferencia" (tal y como la formula Adelardo de Bath), además de pertenecer a una tradición distinta de la de Anselmo, no guarda una relación directa con la expuesta por Guillermo.

Decíamos que la teoría de Guillermo de Champeaux conocida como "teoría de la esencia material" fue revisada por éste a raíz de las críticas de Pedro Abelardo y que fue entonces cuando Guillermo propuso el sistema de la *indifferentia*.[10] En la "teoría de la esencia material" Guillermo se sumaba a la tesis de Porfirio –que también sigue Anselmo– cuando afirma que el universal es *essentialiter* uno y el mismo en muchos individuos; se adhiere también a la terminología del Pseudo-Rabano sobre materia y forma, cuando dice que la especie es la esencia material de los individuos que agrupa y que los accidentes propios de un individuo son su forma. Por tanto, *essentialiter*, uno y el mismo género es la materia de sus especies, y las diferencias son formas de las especies.

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[9] Ante las críticas de Abelardo, Champeaux dirá que los individuos no se distinguen entre sí sólo por sus formas accidentales, sino por sus mismas esencias, de modo que nada de lo que se encuentra en uno se encuentra realmente en otro. La esencia de cada individuo sería, por tanto, realmente distinta de la esencia de cualquier otro, porque ninguno tiene nada en común con otro ni su materia ni su forma. El problema consiste en que, queriendo mantener la universalidad de la esencia, sin caer en las dificultades precedentes, se dirá que las cosas distintas son, sin embargo, idénticas, si no *esencialmente*, al menos *indiferentemente*.

[10] Ver Pedro Abelardo, *Logica Ingredientibus*, ed. B. Geyer: "Peter Abaelard philosophische Schriften I: Die Logica 'Ingredientibus'," en: *Beiträge zur Geschichte der Philosophie und Theologie des Mittelalters* (*BGPTMA*) 21/1 (1919), 10.17-29, 11.3-9.

La idea de Guillermo de que algo puede darse, al mismo tiempo, como individual y comprenderse como universal, no es, como pensaba Abelardo, atribuible a Boecio, más bien parece que esta idea refleja la que propone el Pseudo-Rabano, cuando afirma que el universal no puede existir sin las formas y cuando dice que "hay algo común a los individuos, las especies y el género." Guillermo identifica esta comunidad con el universal: el universal es, en sí, lo mismo, y lo diferente en cuanto que, a través de las formas, se convierte en singulares.

Para poder afirmar que un universal es el mismo en muchos individuos e identificar los universales con los individuales como una misma cosa, llegando a decir que nada existe sino los individuos, Guillermo se sirve de la distinción entre materia y forma postulada por el Pseudo-Rabano y el tratamiento que Anselmo daba al término esencia. Pero, el tratamiento de la esencia en Guillermo, ¿es similar al de Anselmo en cuanto a aquella doble formulación que implícitamente utilizó?

Guillermo aplicó el significado de esencia no sólo a la substancia –como había hecho Anselmo– sino que lo extendió a las diez categorias –algo que ya había hecho Odo de Cambrai. Pero, ¿cómo puede extenderse la esencia a los nueve accidentes? Según cuenta Abelardo,[11] Guillermo de

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[11] *Super Topica Glossae*, ed. M. Dal Pra: *Pietro Abelardo: Scritti di Logica*, Florencia ²1969, 27, 138-272.35. En relación con esta polémica, K. M. Fredborg "Speculative grammar," en: P. Dronke (ed.), *A History of Twelfth-Century Western Philosophy*, Cambridge 1992, 178, cita la opinón de L. Reilly (*Petrus Helia's Summa super Priscianum I-III: an Edition and Study*, Michigan 1978, 575-83), quien ha puesto de manifiesto la posible relación entre alguna de las versiones del comentario anónimo a las *Institutiones Gramaticae* I-XVI de Prisciano, la *Glosule*, y Guillermo de Champeaux. Fredborg ("Speculative grammar," n. 188) identifica esta postura de Guillermo de Champeaux (criticada por Abelardo) con la función del verbo "ser" que se introduce en la tradición de la *Glosule*, a partir de la distinción entre la función copulativa (*vis substantivi*) y la función predicativa (*vis praedicationis*). Otra interesante descripción de la controversia la encontramos en M. M. Tweedale, "Logic in the time of Abelard," P. Dronke (ed.), *A History of Twelfth-Century Western Philosophy*, 213-4.

Champeaux desarrolló una explicación que le permitiera explicar que una frase como "Socrates est albus" no tiene igual significado en un sentido lógico que en un sentido gramatical puesto que, para Champeaux, una misma afirmación que en sentido gramatical nos dice que "Sócrates es el sujeto de la blancura", en sentido lógico querría decir que "la blancura le es inherente a Sócrates"; en este sentido, la expresión *in essentia* muestra lo inherente tanto a lo esencial (en cuanto substancial) como a lo accidental.

Como decíamos más arriba, el platonismo de las teorías de Anselmo, Odo y Champeaux en muy escasas ocasiones ha sido cuestionado. Sin embargo, no parece que al revisar la controversia de finales del once sobre los universales se necesite transitar, necesariamente, por una interpretación que aluda a calificativos como "platonismo" y "aristotelismo" pues, en este período, los autores poseen un conocimiento bastante limitado de las obras de Platón y Aristóteles y, por otra parte, la disputa del s. XI habría estado provocada por la aparición de una teoría no tradicional, con un origen en paralelo al antiguo debate: el "vocalismo".[12] Pero resulta interesante descubrir que la polémica sobre los universales encierra una serie de conexiones que quizás si tienen que ver con las posiciones ontológicas que el "vocalismo" parece asumir. Veamos.

2 Vocales

Recientemente se han expuesto una serie de evidencias sobre algunas de las tesis de los "vocalistas".[13] Todo parece indicar que los nominalistas de principios del doce eran llamados *vocales*, un nombre que más tarde habría sido reemplazado por el de *nominales*. El "vocalismo" habría tenido su inicio alrededor de 1080 a partir de una generación de eruditos anterior a Roscelino, pues el "vocalismo" de la *Dialectica* de Garlando puede llevarnos a considerar un origen más antiguo de la teoría "vocalista". La obra de Garlando ha sido fechada como perteneciente a la mitad del siglo once o algún período inmediatamente anterior (aunque posiblemente esta datación sea incorrecta).

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[12] Iwakuma, "Vocales," (cit. n. 1), en general, es una tesis que defiende a lo largo de todo su artículo.

[13] En especial, los artículos citados en n. 1.

Las fuentes que en la actualidad conocemos han venido a reforzar los argumentos que Reiners ya adelantara[14] cuando, sirviéndose de las fuentes conocidas en su época, planteaba que en la primera mitad del siglo doce, el problema de los universales no giraba en torno a la dicotomía *nominares*, sino en torno a la oposición entre *voces* y *res*; aquellos que afirmaban que los universales son *voces* eran llamados *vocales* y su teoría *sententia vocum* (el término *nominales* habría aparecido con posterioridad a la mitad del doce).

El uso del término *vocales* fue evidenciado por medio de tres textos: el "comentario" a Porfirio del Ms. Milano, Bibl. Ambrosiana, M 63 Sup., fols. 73-81, con el título "Glossae super librum Porphyrii secundum vocales", en realidad, es obra de Pedro Abelardo. El "comentario" a Porfirio que se encuentra en el Ms. Paris Bibl. Nat. lat. 3237, fols. 123ra-124va y fols. 125ra-130ra, donde el autor se adhiere a la teoría del *status*, que aparece por primera vez dentro de la discusión de los universales en la *Logica "Ingredientibus"* de Abelardo; el término *status* también habría sido adoptado por un grupo de "realistas" (cfr. fols. 123vb-125va),[15] parece que el fragmento podría datarse alrededor de 1120, pues la teoría de la *indifferentia* de Champeaux (ca. 1108/9) se desarrolló más tarde en la forma de la teoría de la *collectio* y la teoría del *status*, al introducir distintos tipos de teoría de la *indifferentia*, Abelardo sólo usa *indifferentia* y *colectio* en su *Logica "Ingredientibus"* y la teoría del *status* en su *Logica "Nostrorum petitioni Sociorum"*.[16] El "comentario" a Porfirio que se encuentra en una copia fragmentaria del Ms. Oxford Bodl. Lib., Laud. lat. 67, fol. 6ra-7vb (ca. 1140),[17] parece ser una *reportatio* escrita por Guarinus Cantaber.

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[14] J. Reiners, "Der Nominalismus in der Frühscholastik. Ein Beitrag zur Geschichte der Universalienfrage im Mittelalter. Nebst einer neuen Textausgabe des Briefes Roscelins an Abaelard," BGPTMA, 8/5 (1910), 10-2.

[15] La recopilación de Hauréau ofrece referencias adicionales sobre el uso de la teoría del *status* (cfr. B. Hauréau, *Notices et extraits de quelques manuscrits latins de la Bibliotheque Nationale V*, Paris, 1892, pp. 298-325).

[16] Cfr. *Philosophische Schriften*, ed. Geyer, 13.18-18; 518.9-522.9. Datadas por Constance Mews en ca. 1117/21 la primera y ca. 1120/24 la segunda (cfr. C. Mews, "On dating the Works of Peter Abelard," en: *Archives d'Histoire Doctrinale et Littéraire du Moyen Âge* (= AHDLMA) 52 (1985) , 73-134).

[17] Cfr. L. M. Rijk, *Logica Modernorum: A Contribution to the History of Early Terminist Logic*, Assen 1967, vol 2/1, 77-81.

Como evidencias para probar que la teoría de los *vocales* fue llamada *sententia vocum*,[18] se han aportado las siguientes fuentes: Otto de Freising, *Gesta Friderici I. Imperatoris*, I-49.[19] Un tratado incluido en el Ms. Orléans, Bibl. Mun. 266 (261), "Positio vocum sententie," 276a-278b. Un "comentario" a Porfirio del Ms. Viena VPL 2486, fols. 45ra-60vb que hace referencia a *sententia vocum* (fol. 56ra-rb), para de Rijk[20] este comentario es obra de la escuela de Alberico de Paris. Dos colecciones de textos que agrupan algunas obras de "vocalistas", la primera se encuentra en el Ms. Munich, Bayerische Staatsbibl., clm. 14779; la segunda en el Ms. Pommersfelden, Schloßbibl., 16/2764.

Parece ser que la primera persona que enseñó "vocalismo" fue un tal Joannes,[21] de quien Roscelino habría sido discípulo. Ahora bien, esto contradice claramente la versión de Juan de Salisbury y Otto de Freising sobre la autoría en la aparición de la tesis *vocalista*. Se trata, por tanto, de encontrar "comentarios" a Porfirio que no sigan literalmente los "comentarios" aportados por Boecio a las preguntas de aquél sobre los universales, y donde pueda seguirse la línea que da origen al "vocalismo". Son seis las fuentes donde es posible seguir el estudio de Porfirio desde finales del nueve hasta principios del doce: las "Glosas de Icpa",[22] los

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[18] Aunque como hace notar Iwakuma, la expresión *sententia vocum* también fue usada para significar "el sentido de las palabras," como puede verse en un comentario sobre el *De Differentiis Topicis* que se encuentra en el Ms. Paris Arsenal 910, fol. 48ra, y que de acuerdo con N. J. Green-Pedersen (*The Tradition of the Topics in the Middle Ages: The Commentaries on Aristotle's and Boethius' Topics*, Munich 1984, 426) podría datarse a finales del siglo doce.

[19] "Habuit tamen (scil. Petrus Abelardus) primo preceptorem Rozelinum quendam, qui primus nostris temporibus in logica sententiam vocum instituit, [...]. Sententiam ergo vocum seu nominum in naturali tenens facultate non caute theologiae admiscuit (scil. Petrus Abelardus)" (*Ottonis et Rahewini Gesta Friderici I. Imperatoris*, ed. G. Waitz y de Simon (Monumenta Germaniae Historica 46), Hannover 1978, 69.3-20)

[20] L. M. Rijk, "Some New Evidence on Twelfth Century Logic," en: *Vivarium* 4 (1966), 23-28.

[21] Como han puesto de manifesto Iwakuma, "Vocales" (cit. n. 1), 40, n. 11; Courtenay, "Nominales" (cit. n. 1), 14, n. 19. Cfr. Religieux Bénédictins de la Congrégation de S. Maure (eds.), *Historia Francica, Recueil des historiens des Gaules et de la France*, Paris 1781 (^{2}1877), vol. 12.

[22] C. Baeumker y B. S. von Walterhausen (eds.), "Frühmittelalterliche Glossen des angeblichen Jepa zur Isagoge des Porphyrius," en: *BGPTMA* 24/1 (1924). Para la identificación del autor de las glosas cfr. E. Jeauneau, "Pour le dossier d'Israël Scot," en: *AHDLMA* 52 (1985), 7-72.

Excerpta Categoriarum et Isagogarum;[23] las *Glossae super Porphyrium a magistro W collectae*;[24] el comentario del Ps. Rabano;[25] el comentario que se incluye en el Ms. Munich, clm 14458, fols. 83ra-93ra y el comentario del Ms. Paris BN lat. 17813, fols. 1ra-16va.[26]

Los primeros indicios de la controversia *res-vox* toman parte, de un modo u otro, en el contexto de las discusiones sobre la *intentio Porphyrii*, dentro del esquema escolar de comentario en el cual la *intentio* del autor a comentar es lo primero en discutirse, seguida de la *utilitas*, el *ordo* de la discusión, etc. Según el punto de vista tradicional, "intentio Porphyrii est tractare de quinque rebus, scil. genere, specie ...", lo que parece se incluía en los textos de Porfirio así como en los comentarios de Boecio. Porfirio llamó *res* a los cinco predicables[27] y en su primer comentario a Porfirio,

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[23] *Excerpta Categoriarum et Isagogarum*, Ms. *Vat. Reg. lat.* 1281, fols. 9v-18v, *Quaestiones de minori commento Isagogarum*, Ms. *Paris BN lat.* 8762, fols. 88v-89r.

[24] *Glossae super Porphyrium a magistro W collectae*, Ms. *Erfurt Ampl. Oct.* 5 , fols. 1r-18v; 16r-36v.

[25] La versión más antigua se encuentra en el Ms. Oxford, *Bodl. Libr., Laud. lat.* 67, fols. 9v-14v., cfr. C. Lohr, "Medieval Latin Aristotle Commentaries," en: *Traditio* 23 (1972), 383.

[26] Existe una edición parcial de este comentario publicada por Hauréau, (cfr. B. Hauréau, *Notices et extraits de quelques manuscrits latins de la Bibliothéque Nationale*, vol. V. Paris, 1892, pp. 293-296), aunque parece que J. Dijs está preparando una edición completa. Iwakuma explica que "This commentary must have been written by William of Champeaux himself or a student of his after he revised his theory of universals as a consequence of Abelard's attack in 1108/9. According to Abelard's *Historia calamitatum* (ed. J. Monfrin, Paris 1978, 65.85-91). William revised his theory from claiming that universals are *essentialiter* or *in essentia* the same, to holding that they are *indifferenter* the same. Now the commentary in Ms. Paris 17813 says on fol. 10vb: '*Quidam volunt omnes species et individua esse unum in materia, [...]. Nos autem dicimus a dicens omnes res etiam in essentia esse penitus diversas.*' (The same assertion is also found on. fol. 13ra.) Again, in several places on fol. 9ra it says that those different things are *unum per indifferentiam.* Here we encounter the most primitive 'indifferentia theory'. The *indifferentia* theory developed to the collectio—and status—theory in the 1120's (cfr. n. 6), that is to say, this commentary was probably written in the second decade of the twelfth century" ("Vocales" [cit. n. 1], 43, n. 24).

[27] *Aristoteles Latinus*, I, 6-7, *Categoriarum supplementa*, 5.6, ed. L. Minio-Paluello, Leiden, 1966.

Boecio nos dice que la intención de aquél guarda relación con los cinco predicables.[28]

De los seis comentarios reseñados, los tres últimos recuerdan que alguien había dicho que "intentio Porphyrii est tractare de quinque vocibus", pero no "de quinque rebus".

Estos textos podrían estar indicando algo más que una simple caracterización de la *intentio Porphyrii*. En realidad, van más allá de una interpretación particular de la ofrecida por Boecio; quiere decirse que identificar las categorías aristotélicas como *voces*, implica una lectura general sobre el significado que las *Categorías* encierran en el conjunto de la lógica. En este sentido, el "vocalismo" podría estar identificando la relación de los predicables, en tanto que *voces*, con un carácter "sermoncial" de la lógica, distinguiéndolo de su carácter ontológico y, por tanto, situarse frente al realismo inherente a la identificación categorías-*res*. De este modo, el problema no estaría en los arriesgados postulados del tal Joannes sino en la consecuencias que se derivan de su interpretación –el que su postura se extendiera a la teoría a los universales– tal y como va a ser formulada por el alumno de Joannes, Roscelino de Compiègne.

Es aquí donde parece que la polémica con el "realismo" podría tener su punto de partida pues para los "realistas" quizás no resultase estridente decir que el objeto de la *Isagoge* y la lógica en general son las *voces*. Tal vez por ello las seis primeras fuentes citadas atribuyen a Roscelino la paternidad del "vocalismo" y la designación de sus teorías como *sententia vocum*, pues el problema, tal y como fue expuesto por Joannes, no habría suscitado la polémica que condujo a los "realistas" a establecer una profunda línea divisoria entre su interpretación y las teorías "vocalistas" sobre los universales expuestas por Roscelino.

Hay otros datos que pueden aportar más luz sobre la cuestión del inicio del "vocalismo" en relación con el nominalismo y el problema de los universales, en tanto que precedente; estos datos podrían seguirse a través del estudio de los autores que suelen ponerse en relación con Roscelino o dentro del ámbito del "vocalismo". En este sentido, aunque las fuentes aportadas sólo citan como "vocalistas" a Joannes, Rainberto de Lille, Rotberto de Paris, Arnulfo de Laon, Roscelino de Compiègne y

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[28] *Anicii Manlii Serverini Boethii in Isagogen Porphyrii Commenta*, 7.2, *Corpus Scriptorum Ecclesiasticorum Latinorum*, vol. 48, ed. S. Brandt, Vindobonae/Lipsiae, 1904 (reimp. New York/London, 1966).

Pedro Abelardo, en realidad, el listado queda sobrepasado desde el momento en que algunas fuentes comienzan a ser clarificadas y la reasignación de ciertos autores a otros tantos manuscritos desdibuja el horizonte conocido sobre los orígenes del nominalismo. En este contexto, el estudio de un autor como Garlando "el Computista" se revela como una senda de particular interés para el seguimiento de dichas relaciones, pero también como indicio de una evidencia, a saber, el conocimiento de la *logica nova* que poseían los autores a principios del doce. Puede considerarse la fecha de 1100 a 1120-30 como la más fiable para la datación de la *Dialectica* de Garlando; pero hay algo más, y esto es lo que aquí nos interesa: las similitudes del texto de Garlando con algunos de los textos de Abelardo ha llevado a la crítica a plantear la posibilidad de lo que podría constituir una interesantísima conexión entre Garlando y Abelardo.

En su *Dialectica*,[29] Garlando afirma que la cópula no es una parte de la proposición sino del predicado, un punto de vista que fue utilizado por Abelardo en su propia *Dialectica*;[30] también comparten el planteamiento sobre la predicación *principaliter* y *secundarie* y coinciden, además, en que para ambos, los asuntos que se discuten apelan a la proposición *categorica* o *praedicativa*, pues en ellas el predicado es la parte más importante, incluso por encima del sujeto. Comparten también una misma interpretación del concepto de *numerus* que Porfirio[31] utiliza para definir las especies, pues uno y otro lo entienden como *collectio* de accidentes particulares a un individuo; y aunque la idea de la *collectio* también está en Porfirio, la originalidad de Abelardo y Garlando consiste en combinarla con el concepto de *numerus*. Finalmente, los pasajes de la *Editio* (1102/1108) de Abelardo en que se avanza en esta dirección no siguen su obra precedente, y en la que se basa gran parte de ésta (la *Disputata Porphyrii*) lo que hace suponer que en el lapsus de tiempo transcurrido entre una y otra, Abelardo habría conocido las tesis de la *Dialectica* de Garlando.

Si la obra perteneciese a este período, Garlando no sería aquel Garlando "el Computista" del que se suele hablar. Puede conjeturarse que se trata de Gerlando de Besançon,[32] quien pudo haber sido alumno de Roscelino y –como ocurre con Thierry de Chartres– podría haber pertenecido a la primera generación con acceso a la *logica nova*. Por otra parte, parece que Abelardo y Thierry mantenían cierta amistad, puesto que habían permanecido juntos en el Concilio de Soisson (1121), lo que hace pensar que Abelardo tuvo cierto conocimiento tanto de la *logica nova* como de la obra de este Gerlando.

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[29] Ibid., 7; 45-7.

[30] Petrus Abaelardus, *Dialectica*, ed. L. M. De Rijk, Assen ^{2}1970, Tratados I-II; *Editio super Porphyrium*, ed. Dal Pra (cit. n. 27), 10.25-27.

[31] Cfr. Porfirio, *Isagoge*, ed. L. Minio-Paluello, 14.1.

Pero, si esto es así, ¿hacia dónde podemos remontarnos para dibujar la fijación del nominalismo a partir del "vocalismo"?

3 Nominalismo

El debate en torno a los orígenes del nominalismo se encuentra estrechamente vinculado con el entorno temático que puede dar sentido a su aparición; ahora bien, el análisis y los criterios sobre el contexto y el objetivo perseguido por el nominalismo se encuentran algo alejados, no existiendo unanimidad en la interpretación. Algunos de los artículos citados son un buen ejemplo para ilustrar la difícultad en poder alcanzar unos criterios unánimes sobre el tema; en parte, porque los distintos posicionamientos manifiestan una clara adscripción con respecto a dos líneas de interpretación divergentes. En el caso de Iwakuma se patentiza un cierto seguimiento de la trayectoria emprendida por Vignaux y seguida, entre otros, por Reiners; en cuanto a Courtenay, su reconocimiento a la labor emprendida por Chenu, lo sitúa dentro de una trayectoria crítica en torno a la lectura tradicional sobre el nominalismo y, por tanto, su alejamiento de tesis clásicas como las de Vignaux, lo sitúan al otro lado de la crítica.

Según Courtenay,[33] en la intepretación sobre el origen y significado del nominalismo es posible comprobar que nuestra perspectiva historica ha quedado determinada por una línea de investigación iniciada en los primeros años de nuestro siglo, y que puede agruparse bajo la figura representativa de Paul Vignaux[34] y sus investigaciones. Aunque Vignaux y Chenu[35] tuvieron muy distintas audiencias entre las investigaciones de los medievalistas de las primeras décadas del veinte, ambos gozaron de una repercusión muy desigual en el seguimiento que la investigación posterior realizó sobre sus trabajos.

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[32] Cfr. Iwakuma, "Vocales" (cit. n. 1), § 3.

[33] Courtenay, "*Nominales*" (cit. n. 1), 11-2.

[34] P. Vignaux, "Nominalisme," en: *Dictionnaire de théologie catholique*, Paris 1930, vol. 9/1, cols. 717-84; "Occam," col. 876-89. Vignaux volvió a este tema en varias ocasiones: *Nominalisme au XIVe siècle*, Paris /Montreal 1948; idem, "Note sur le nominalisme d'Abélard," en: R. Louis, J., Jolivet y J. Chatillon (eds.), *Pierre Abélard-Pierre le Vénérable*, (Coloquios Internacionales del C.N.R.S. 546,

En cuanto a Paul Vignaux, sus artículos llegaron a ser una de las guías interpretativas para los estudiosos que trabajaban en el nominalismo de la Alta Edad Media. Su artículo sobre el nominalismo fue la culminación de un intenso período de trabajos de investigación, llevados a cabo en el primer decenio de este siglo y dirigidos fundamentalmente por Reiners, Geyer, Baumgartner y De Wulf.[36] Entre todos ellos existía una clara unanimidad a cerca del significado del nominalismo: era un punto de vista particular del *status* existencial de los conceptos universales; nominalista serían aquellos que creían que los universales eran simples nombres (*nomina*) o sonidos hablados (*voces*); por su parte, el realismo afirmaba la existencia de los universales en las cosas (*in rebus*) y, de forma más extrema, su existencia como cosas.

En el diecinueve, algunos estudiosos habían intentado trazar los orígenes del nominalismo volviendo a autores del siglo nueve tales como Rabano Mauro, Escoto Eriúgena, Erico de Auxerre y otros.[37] Reiners rechazó a quienes buscaban un proto-nominalismo y situaban los orígenes

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Abadia de Cluny, 2 al 9 de Julio de 1972), Paris 1975, 523-9; idem, "La problématique du nominalisme médiéval peut-elle éclairer des problèmes philosophiques actuels?," en: *Revue philosophique de Louvain* 75 (1977), 293-331.

[35] M-D. Chenu, "Contribution à la l'histoire du traité de la foi," en: *Mélanges thomistes*, Paris 1934, 123-40; idem, "Grammaire et théologie eux XIIe et XIIIe siècles," en: *AHDLMA* 10 (1935-36), 5-28; idem, *La théologie au douzième siècle*, Paris 1957, 90-107.

[36] J. Reiners, "Der Nominalismus in der Frühscholastik," en: *BGPTMA* 8/5 (1910); B. Geyer, "Die Stellung Abälards in der Universalienfrage nach neuen handschriftlichen Texten," en: *BGPTMA* Suppl. 1 (1913), 101-27; F. Überweg y M. Baumgartner, *Geschichte der Philosophie der Patristischen und Scholastischen Zeit*, Berlin 1915; M. De Wulf, *Histoire de la Philosophie Medievale*, Louvain ^{2}1925; F. Überweg y B. Geyer, *Die Patristische und Scholastische Philosophie*, Berlin 1928 (repr. Basel 1958).

[37] V. Cousin, *Ouvrages inedits d'Abelard*, Paris 1836, 85 y ss.; B. Haureau, *De la Philosophie Scolastique*, Paris 1850, vol. 1, 141-3; idem, *Histoire de la Philosophie Scolastique*, Paris 1872, vol. 1, 193; 196; K. Prantl, *Geschichte der Logik im Abendlande*, Leipzig 1861, vol. 1, 81; K .S. Barach, *Zur Geschichte des Nominalismus vor Roscelin*, Wien 1866. Véase también J. Marenbon, *From the Circle of Alcuin to the School of Auxerre Logic Theology and Philosophy in the Early Middle Ages*, Cambridge 1981.

del nominalismo en una controversia sobre los universales a finales del s. XI, que inicialmente se habría centrado en torno al pensamiento de Roscelino.

La posición de Abelardo, considerada como una modificación del pensamiento de Roscelino, parece que fue la versión que llegó a ser conocida como nominalismo en el tiempo de Juan de Salisbury. Fue Abelardo quien sustituyó el término *vox* de Roscelino por el de *sermo* (equivalente a *nomen*) de acuerdo con Reiners.[38] Con independencia de esa formulación sobre el significado y origen del nominalismo, los eruditos, antes y después de Vignaux, trataban sobre problemas como las diferencias entre las versiones de Roscelino y Abelardo, la naturaleza y el grado exacto del nominalismo de Abelardo, la relación entre una visión nominalista de los universales y una lógica nominalista y las líneas de continuidad o discontinuidad entre el nominalismo del siglo doce y el de Guillermo de Ockham.[39]

Los artículos de Chenu se revelaron como un material de especial interés para el estudio del nominalismo del siglo doce. Si Chenu, o aquellos que trabajaban en la gramática y la lógica del siglo doce, hubieran concretado las implicaciones que se derivaban de sus evidencias sobre el origen y significado del nominalismo, la historia de la investigación sobre el nominalismo quizás habría transcurrido por otros derroteros. Pero las evidencias de Chenu y un extenso número de citas, reunidas independientemente por Landgraf,[40] nunca fueron completamente aplicadas a la cuestión sobre el origen y significado del nominalismo. Las evidencias presentada por Chenu sugieren que el título *nominales* aparece dentro de un contexto de debate sobre el objeto de la fe, especialmente tal y como se expresaba a través de los enunciados temporales (*enuntiabilia*) de quienes vivieron antes, durante y después del tiempo de Cristo. El objeto de la fe no podía ser simplemente el hecho histórico, puesto que sólo los enunciados y las proposiciones sobre los acontecimientos o la realidad externa pueden ser afirmados o negados. Si los artículos de fe son afirmados (en tanto que enunciados) por los creyentes o negados por los infieles, versan sobre acontecimientos "futuros" para Abrahán y "pasados" para los cristianos, entonces ¿de qué modo puede ser idéntica la creencia de aquellos que vivieron antes y después de la Encarnación? La *opinio nominalium* afirmaba que la entidad o la realidad significada por la proposición puede ser idéntica a lo largo del tiempo, de manera que lo que es verdadero en una época se mantiene verdadero para todo tiempo (*semel est verum, semper est verum*). Así como hay unidad o identidad en la principal significación de un nombre (*nomen*) que se encuentra bajo la co-significación de sus varias formas (*voces consignificativae*) o los modos de significar (*modi significandi*), tales como el caso, género y número, del mismo modo se da la significación de un verbo que se encuentra bajo las distintas significaciones compartidas de tiempo, voz y modo; y así como muchas *voces* son un *nomen*, distintos *enuntiabilia* son un artículo de fe.[41]

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[38] Reiners, *Nominalismus* (cit. n. 36), 57-9; Vignaux, "Nominalisme" (cit. n. 34), 718.

[39] Baumgartner y Geyer pensaban que la separación entre los seguidores de *nominales* o *reales*, en la baja Edad Media, provenía directamente de la practicada en el doce, cfr. Überweg/Baumgartner, *Geschichte der Philosophie* (cit. n. 36), 598-9; Überweg-Geyer, *Die Patristische* (cit. n 36, 575). De Wulf afirma que en el catorce Roscelino y Abelardo no eran conocidos, y que el nominalismo de los dos períodos es distinto: *Histoire de la Philosophie*, (cit. n 36), 168.

[40] A. M. Landgraf, "Studien zur Theologie des zwölften Jarhrhunderts," en: *Traditio* 1 (1934), 183-222. C. Normore, "The Tradition of Medieval Nominalism," en: J. F. Wippel (ed.), *Studies in Medieval Philosophy*, Washington D. C. 1987, 201-17.

Las evidencias de Chenu sugerían que los *nominales* fueron llamados así porque transformaron la teoría gramatical de la unidad del nombre –con sus raíces en la gramática antigua extendida por Bernardo de Chartres y otros– en una teoría sobre el objeto del conocimiento y la creencia, una teoría sobre la verdad proposicional que fue aplicada a los problemas teológicos de la inmutabilidad del objeto de la fe y al problema paralelo de la inmutabilidad del conocimiento divino.[42] Todas las referencias a los *Nominales* o la *opinio Nominalium* compiladas por Chenu, a partir de fuentes de finales del doce y del trece, son de este tipo y el problema de los universales no forma parte de ellas, al menos de forma directa, antes del tercer cuarto del siglo trece. Fue Landgraf, que aparentemente desconocía los artículos de Chenu, quien al descubrir de forma independiente un conjunto mayor de evidencias similares, reintegró la visión tradicional sobre el origen y el significado del nominalismo con la esperanza de que podía ser posible agrupar toda la enseñanza nominalista –incluyendo la enseñanza de los universales– dentro de un cuadro unificado de la enseñanza de la “escuela” nominalista.

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[41] Chenu, "Grammaire" (cit. n 36), 13, cita un conjunto de *Quaestiones* anónimas recogidas en el Ms. Paris Bibl. Nat. Nouv. acq. lat. 1470, fol. 25r.

[42] Juan de Salisbury, *Metalogicon*, I.24; III.2 (ed. C. C. J. Webb, Oxford 1929, 55-6; 124-7). Cfr. Chenu, "Grammaire" (cit. n. 35), 14-7.

En referencia con lo anterior, se han formulado algunas preguntas:[43] ¿pudo ocurrir que un acercamiento de base nominalista hacia la lógica, con una teoría de los universales como pieza central, hubiese cobrado alguna significación desde la mitad del doce, quedando asociado sólo con uno de sus puntos de doctrina?, ¿o es que el verdadero origen del nominalismo, tal y como fue entendido en los siglos doce y trece, se apoyaba sobre la teoría de la unidad del nombre, y nadie bien informado en ese período habría aplicado la etiqueta de nominalismo a una teoría de los universales o a cualquier definición moderna sobre el nominalismo medieval?. ¿Es el desarrollo descrito por Chenu un caso de restricción a “una” tesis, la denominación que fue creada para un conjunto de doctrinas, o se trata de una completa aproximación a la lógica?, ¿eran los escasos pasajes que parecen conectar el nominalismo con un *ars sermocinalis,* la aproximación a la lógica de la parte de un todo, *i.e.*, caracterizar una aproximación gramatical a la lógica, por medio del nombre de un subgrupo particular?

Durante mucho tiempo, las dicotomias *vox-res* y *nominales-reales* fueron consideradas equivalentes, pues al definir el realismo por referencia a *res*, parecía natural asumir que al término *vox* le era inherente el nominalismo. De hecho, el término *nominales* del *Glosarium* de 1678 de Du Cange agrupaba las referencias a los *nominales* con la de los defensores de la lógica *sermocinabile* e *in vocibus*;[44] y aunque los estudiosos habían separado la teoría abelardiana del *sermo* de la teoría de la *vox* en Roscelino,[45] ambas continuaron siendo consideradas como formas diferentes de nominalismo, en parte debido a que se encontraron con una afianzada comprensión moderna de “nominalismo lógico” en contraste con el “realismo lógico”. De este modo, “lógicos realistas” habrían sido quienes creían que los verdaderos objetos del conocimiento filosófico son las cosas (*res*), la realidad externa y no los términos *verba* o *enuntiabilia*, es decir, los que asumían que los conceptos, los términos, las proposiciones y los argumentos lógicos se refieren directamente a objetos y estado de las cosas en la realidad externa. En cambio, "lógicos nominalistas" habrían sido aquellos que asumían que la lógica es un *ars sermocinalis* que trata sobre entidades lógicas y sobre el modo como opera el lenguaje, considerando la realidad externa como un problema a tratar indirectamente. De Rijk ya había apuntado que, en el caso de Abelardo, aunque las interpretaciones "realista" y "nominalista" sobre los universales recibieran la mayor atención por parte del "realismo" y el nominalismo, sólo eran aplicaciones particulares de ciertas consideraciones sobre la naturaleza de la lógica que, en realidad, respondían a fundamentos muy diversos[46] (en este sentido, considero muy clarificadora la nota que Courtenay introduce en uno de sus artículos).[47]

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[43] Entre las más “incisivas” conviene destacar las que W. Courtenay ha formulado (cfr. “*Nominales*” [cit. n. 1], 13).

[44] C. Du Cange, *Glossarium mediae et infimae Latinitatis*, Paris 1845, vol. 4, 638.

[45] Juan de Salisbury, *Metalogicon*, II, 17 (Webb [cit. n. 42], 92).

Pero, aunque resulta de gran utilidad conocer las descripciones del realismo y nominalismo tal y como fueron concebidas por Abelardo y sus contemporáneos, Courtenay cree que se podría caer en una simple divagación si usasemos estas definiciones para resolver el problema sobre el origen del término *nominales,* o para comprender lo que significaba el nominalismo en el siglo doce; pues los muchos significados que el término ha recibido a lo largo de quinientos años no son una guía segura para entender el significado que tuvo en el doce o cómo se originó esta denominación. Debemos volver a comenzar por las fuentes del siglo doce para así poder reconocer que, cuando en el último cuarto del siglo doce comienzan a darse numerosas referencias sobre las *opiniones Nominalium*, comienza a despejarse la relación entre denominación y doctrina, tal y como fue utilizada por los teólogos de la época.[48]

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[46] Pedro Abelardo, *Dialectica* (cit. n. 30), XCIII.

[47] "The priority of the nature of logic over the issue of universals is also characteristic of fifteenth-century nominalism. To the famous Parisian defense of their view in 1474 the Nominalists defined themselves as believing that multiple terms and linguistic expressions could be used for the same external things, and that logic comprised the ways in which terms function in propositions. Realists, by contrast, were credited in the same document with the view that each linguistic form described an extra-mental reality, and that logic was directly concerned with things, *res,* not linguistic terms, *incomplexa, termina,* or *verba.*" (Courtenay, "*Nominales*" [cit. n. 1], 32, n.16).

[48] Courtenay comenta que "The labels *Nominales, Nominalis, via Nominalium*, or *opinio Nominalium*, which occur in the writings of Peter the Cantor, the Mazarine anonymous, Peter of Capua, Praepositinus, William of Auxerre, Godfrey of Poitiers, Roland of Cremona, Albertus Magnus, Bonaventure, and Thomas Aquinas, are more than sufficient to identify a set group of related positions encountered frequently in twelfth century works. The principal passages for

Finalmente, al tratar de responder a las preguntas sobre el período en que la aplicación de estas teorías del nombre recibió un tipo de atención especial que indujo autilizar la designación *nominales*; sobre si fue entre los gramáticos, los lógicos o los teólogos y cuándo se originó el fenómeno, parece que el peso de las evidencias inducen a pensar que la denominación *nominales* aparece como resultado de la aplicación de las "teorías sobre el nombre" a la lógica y la teología. En parte, esta "enseñanza" o técnica tuvo que ver con una errónea utilización de algunos términos tal y como fueron usados en las proposiciones y, en general, tiene que ver con la teoría de la *unitas nominis*. La denominación no parece que hubiera sido el resultado de unas disputas sobre el "status" ontológico de los universales o sobre el referente de una proposición universal.

Decir que el universal es una *vox* nada tiene que ver con decir que es un *nomen*. Las *voces* pueden extenderse desde los sonidos articulados indeclinables que transmiten algún significado (p. e. el canto de un pájaro) hasta significar y co-significar expresiones verbales. La *vox* puede ser un signo verbal de un equivalente mental, lo mismo que una palabra escrita es un signo para una palabra hablada, pero nunca es algo mental sino siempre verbal. El *sermo* de Abelardo (aunque quizás no su *dictum*) puede diferir entre lenguas habladas, pero nada tiene que ver con el problema de la verbalización. *Sermo* es el significado comúnmente aceptado de una palabra que, impuesto por convención humana, permanece inalterable sea o no dicho. El mismo *sermo* está a la base de cualquier instancia de la *vox* verbalizada equivalente. Por su parte, el *nomen* no está ligado a un lenguaje particular porque es un equivalente mental común.

La tesis de los nominalistas "un *nomen*, muchas *voces*" no era una distinción entre el nombre y otras partes del habla, ni era simplemente la distinción entre significación y co-significación, o entre significado raíz e inflexiones gramaticales, aunque estas últimas distinciones están más cerca de sus enseñanzas. *Nomen* era una entidad mental; el *nomen* que descansa tras las muchas *voces* era una unidad "inflexiva" de significación del pensamiento que se apoya en sus distintas formas verbales: todas las

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determining the meaning of *Nominales* are those in which that label is linked with a particular form of argumentation and resulting conclusions. We are also safe in assuming that where those same auguments and conclusions occur, *opiniones Nominalium* are under discussion. Conclusions alone are insufficient, since they could have been arrived at by other arguments" ("*Nominales*" [cit. n. 1], 36, n. 37).

lenguas en las que esa entidad mental podría ser expresada, así como las formas gramaticales de estas lenguas. La aplicación de la teoría del *nomen* tenía que ver con acontecimientos particulares, personas y proposiciones, y aunque la teoría fácilmente podría ser aplicada a los términos universales, hay escasas evidencias de que esto así se hiciese.

En cierto sentido, podría parecer que todo esto va directamente en contra de la comprensión tradicional sobre el nominalismo y el realismo: los nominalistas fueron quienes buscaron la unidad hipotetizando una entidad más allá de los particulares individuales de nuestro mundo temporal; los "realistas" fueron aquellos que se tomaron en serio los cambios que el tiempo origina y, eventualmente, abandonaron la estricta inmutabilidad. Los orígenes de los puntos de vista de los *nominales*, aunque de algún modo dependientes de las observaciones gramaticales de la *logica vetus* de Aristóteles, estarían más en deuda con el platonismo y, en particular, con el pensamiento de Agustín. La teoría del nombre no fue creada inicialmente como una solución al problema de los universales ni fue ese el uso principal que Abelardo le dio, aunque también la aplicase a este problema. Abelardo aplicó la teoría en su discusión sobre las inferencias necesarias y la relación de las *enuntiationes* con la existencia *in re* de sus términos sujeto y predicado.[49]

Tradicionalmente se ha mantenido que los *nominales* eran seguidores de Pedro Abelardo. Pero, hemos visto que frente a la interpretación dominante encabezada por Vignaux y aceptada sin muchas críticas, Chenu propuso una alternativa y, en este contexto, Courtenay ha vuelto a plantear serias dudas sobre aquella corriente interpretativa iniciada a principios de siglo, proponiendo, a su vez, una revisión crítica.

4 Una exposición de la teoría de la *indifferentia*, el *de eodem et diverso* de Adelardo de Bath

Como quiera que las expresiones "platonismo" y "aristotelismo" forman parte de una tradición inveterada al explicar no ya las raíces sino la "inclinación" de una filosofía, el realismo de Anselmo tendría que ser caracterizado como "aristotélico", entre otras razones porque sus teorías se vieron transformadas dentro de la teoría de la *indifferentia*.

Entre las obras o fragmentos de autores contemporáneos a Anselmo donde parece evidenciarse el carácter "aristotélico" de sus tesis, algunas investigaciones han citado a Herman de Tournai como una fuente de interés,[50] pues en su crítica del "vocalismo" se asume que Anselmo y Odo de Cambrai siguen a Boecio y a los antiguos al intepretar a Porfirio y Aristóteles presuponiendo que Boecio se declara explícitamente seguidor de la tradición peripatética y no de la "platónica".

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[49] Pedro Abelardo, *Dialectica* (cit. n. 30), 281-6.

Para encontrar una teoría "platónica" de los universales habría que dirigirse a los intentos de reconciliación del "platonismo" con el "aristotelismo" que se aportan entre los siglos once y doce. El más antiguo se encuentra en un "comentario" a Porfirio del Ms. Munich *clm 14458*, fol. 85rb-va, donde se niegan, deliberadamente, las diferencias entre las teorías de Platón y Aristóteles, pues aunque la tesis que se defiende es la misma que desarrolla el Ps. Rabano, el autor del "comentario" de Munich cree que puede reconciliarla con Platón. Detrás de dicha intención podemos encontrar el propósito de introducir una idea de raíz platónica en la teoría del universal, a saber, que los universales guardan cierta relación con los "ejemplares" en la mente divina.

Otro intento de "reconciliación" se encuentra en el *De eodem et diverso* de Adelardo de Bath. En este libro podemos encontrar una interesante formulación de la *indifferentia*,[51] a través de una incursión en el problema de los universales comparable a la del Pseudo-Rabanus y la del "comentario" de Munich pero, a diferencia del Pseudo-Rabano, Adelardo de Bath no habla de *essentia*, lo que puede implicar que el "Comentario" de Munich y el texto de Adelardo se encuentran fuera del ámbito de la tradición anselmiana. Aunque la teoría de la *indifferentia* es atribuida a Guillermo de Chapeaux, curiosamente Hauréau[52] la asignó a Gauthier de Mortagne. Hauréau también había señalado que la exposición de Gauthier guarda un interesante paralelismo con el *De generibus et speciebus* (atribuido erroneamente por Cousin[53] a Pedro Abelardo; su autor parece ser un discípulo de Jocelin de Soissons), y con el *De eodem et diverso* de Adelardo de Bath.

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[50] Iwakuma cita el *Herimanni Liber de restauratione monasterii Sancti Martini Tornacensis*, *MGH*, SS 14, p. 275 (cfr. Iwakuma, "The Realism of Anselm and his Contemporaries" [cit. n. 1], 17).

[51] Ms. Paris, Bibl. Nat., Lat. 2389, fol. 81va-91vb (ca. 1110), citado por Jourdain en sus *Recherches critiques sur l'âge et l'origine des traductions latines d'Aristote*, 26; 97-9; 258-77; 452-4, Paris 1843, editado por H. Willner, en: *BGPTM* 4/1 (1903). C. Burnett (ed.; colab. I Ronca, P. mantas España y B. van den Abeele), *Adelard of Bath, Conversations woth my Nephew: On the Same and the Different, Questions on National Science, and On Birds*, en prensa, va a presentar una nueva edición latina con trad. en inglés. Para la edición bilingüe latín-castellano, cfr. P. Mantas España, *El "De eodem et diverso" de Adelardo de Bath: la búsqueda de una "síntesis" en el Renacimiento del siglo doce*, Córdoba 1995, 208-60 y "Apéndice I".

[52] Hauréau (cit. n. 37), vol. 1, cap. 14.

Lo mismo que para Odo de Cambrai, el *Timeo* le es bien conocido a Adelardo, por lo que no es extraño que su círculo de influencias esté claramente determinado por el "platonismo" que impregna toda la época, aunque ello requiera algunas matizaciones: precisamente, una cuestión central para el conocimiento de los siglos once y doce se deriva del problema sobre la tradición desde la que una teoría se reconoce o es leída como "platónica", tanto como la indudable limitación de acceso a la obra de Aristóteles, el uso y las vías de intepretación de lo que se entendía como "aristotélico";[54] de hecho, el propósito de este trabajo también pretende ser una aclaración conmigo mismo sobre esta problemática.

El "comentario" de Munich quizás sea una buena fuente para orientarse en la exposición seguida por Adelardo y el Pseudo-Rabano, pero, al contrario que éste, cuando Adelardo ofrece una interpretación sobre el problema de los universales, no usa el término *essentia*[55] (el Pseudo-Rabano utiliza el término “essentialiter”). Pero, ¿hasta dónde alcanza el “platonismo” de Adelardo?

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[53] Cfr. V. Cousin, *Ouvrages inédits d'Abelard*, Paris 1836, 505-50. Ha sido reeditada y traducida al inglés por P. King, *Peter Abailard and the Problem of the Universals*, Michigan 1990, vol. 2, 143-212.

[54] En Iwakuma, "Realism" (cit. n. 1), n. 35, se cita un comentario de Charles Burnett sobre "Ocreatus" (un alumno de Adelardo de Bath), que ilustra el buen conocimiento que de Aristóteles y Platón se tenía en su escuela: "C. Burnett drew my attention to a fragment of a Porphyry commentary in Ms. Cashel, GPA Bolton Libr., 1, pp. 118-120. It pays a special attention to the difference between Plato's and Aristotle's theories. [...] it says on p. 118: 'Sed sciendum quod apud Platonem aliter, apud Aristotelem aliter de partibus logicae, sicut de ceteris compluribus dictum est [...]'. And the discussion of Porphyry's questions begins (p. 20): 'Sed quia, ut dictum est, aliter innuit Plato, aliter sensit Aristoteles, Platonis et ipsius sequentium videamus sententiam. Dicebat igitur Plato genera et species esse exemplares illas rerum formas quas ideas vocant, id est intellectus illos in mente divina quos de rebus singulis [...].' No contemporary commentaries share this style. According to Ch. Burnett, this commentary is the only text to occur in the same part of the composite codex besides the curious arithmetical text written (according to the only other manuscript) by Ocreatus, [...] It might have been the case, then, that in Adelard's school they were sharp at the distinction between the two ancient philosophers." Sobre Ocreatus, cfr. Ch. Burnett, "Ocreatus," en: M. Folkerts y J. P. Hogendijk (eds.), *Vestigia Mathematica: Studies in Medieval and Early Modern Mathematics in Honour of H. L. L. Busard*, Amsterdam 1993, 69-78.

Para Adelardo de Bath, las ideas humanas son innatas. Dios ha provisto el mundo de una cierta naturaleza, de cierta substancia “ideal” que nosotros llamamos alma, donde de algún modo están presentes las formas de las cosas creadas. La idea no es, como piensa Aristóteles, un producto de la razón humana sino que pertenece al tesoro de la memoria, donde Dios la ha situado desde el origen del mundo; pero cómo afirmar entonces la permanencia objetiva de géneros y especies, recurriendo al “sistema de la indiferencia” para mostrar que se puede sostener la realidad de los universales, sin añadir alguna substancia al número de substancias que Dios mismo ha creado.

El “sistema de la indiferencia” de Adelardo se aleja del expuesto por Champeaux, para quien el universal soporta a los individuos como formas accidentales; para Adelardo, el individuo incluye todos los modos de ser: aquello que es particular, aquello que es general, aquello, en fin, que es más general, pero entonces ¿es el “sistema de la indiferencia” un “realismo” sin más?

Para los partidarios del “sistema”, afirmar que “nihil omnino est, praeter individuum” quiere decir que absolutamente nada existe en la naturaleza sino el individuo, al que se atribuyen, como predicados substanciales, la especie el género y lo demás. Lo que podría llevar a interpretarlos como aristotélicos sino fuera porque al distinguir entre esencia y substancia, diciendo que toda substancia es individual pero, al mismo tiempo, es lo que hay de más universal. Aunque esta interpretación podría ser explicada en sentido aristotélico, puesto que Aristóteles se sirve del mismo término *ousía* para designar tanto aquello que es más individual cuanto aquello que es más general.

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[55] Para Adelardo: “Puesto que la misma cosa que ves es género, especie e individuo, Aristóteles propuso con acierto que éstos no existen sino en los objetos sensibles. Pues ellos mismos son los sensibles, incluso si fuesen considerados con más agudeza. Aunque, como nadie puede mirarlos de cerca y puramente sin imaginación, en tanto que son llamados géneros y especies, Platón dijo que éstos son concebidos y existen fuera de los sensibles, esto es, en la mente divina. Por tanto, aunque en sus palabras parecen ser contrarios el uno al otro, aquellos hombres, de hecho, piensan lo mismo.” (*De eodem et diverso*, trad. P. Mantas España, Adelardo de Bath, *Sobre lo idéntico y lo diferente*, en idem [cit. n. 51], cap. 3, “La traducción del ‘De eodem et diverso,” 225-6; para el fragmento completo véase 223-6).

Podría decirse, aunque hoy podemos dudar de una interpretación así, que en el sistema de los nominalistas, el individuo considerado aparte es la substancia misma, y todo lo que se añade al individuo deviene por él substancial; el individuo es la substancia y por él son la especie y el género, que sin él no pueden darse. Ahora bien, la tesis de la "indiferencia" tiene por objeto demostrar la proposición contraria: que con respecto a la substancia, el individuo viene después que la especie, la especie después del género, el género después del universal. Para este "sistema", la substancia no es aquello que estando en todo ser admite o acoge el género y la especie como formas simples, aunque en nuestro mundo "inferior" no pueda ser separada de estas formas. Quién es, entonces, el sujeto de toda realidad, cuál el primer acto con respecto al que toda otra condición del ser es definida como circunstancia adventicia. Siguiendo a los partidarios de la "indiferencia", no puede tratarse del individuo, sino de aquello que se encuentra "indiferente" en los individuos, es decir, en primer lugar la substancia, después el género y la especie.

Esta podría ser la exposición tal y como la podría haber presentado Pedro Abelardo. En cambio, para Adelardo de Bath la indiferencia suprema es la substancia. La substancia que recibe las diferencias entre género, especie e individuo, y siendo lo indiferente en grado máximo, es ella por sí misma y se comunica con sus inferiores. Así, el ser emana de ésta y desciende primero hacia el género, de aquí a la especie y de ésta hacia las cosas que agrupa. Si el género es un nombre que, en el uso común, se emplea para significar cierta vía colectiva de las cosas, los partidarios de la indiferencia no rechazan esta definición usual de género, pero, a su vez, hacen notar que la individualidad o la "haeccidad", son nombres de los que se sirve los filósofos para significar la diversidad numérica de los fenómenos. En el orden del conocimiento, el individuo viene primero; en el orden de la generación, el universal y el particular vienen juntos; no hay especie sin individuos ni géneros sin especies; en el orden de la definición, es el universal quien primero se presenta. La definición de lo "indiferente" descansa sobre la substancia permanente, en tanto que la definición de lo diferente no es sino una forma efímera, una afirmación manifiestamente "realista". Pero no se trata del "indiferente" natural, del universal *in re* no separado de las diversas formas entre las cuales se compone el sentido de las cosas. El *De eodem et diverso* tambén nos da a conocer el sentido de la "indiferencia" sobre el universal *ante rem*. Entonces ¿son "eclécticos" los partidarios de la "indiferencia"?

Adelardo de Bath pretende conciliar a Platón y Aristóteles, una actitud que no era nueva. Puede decirse que el sistema de la "indiferencia" es "realista" porque define el universal *in re*, pero no en cuanto aquello que puede decirse de todos los seres, sino del ser común –el sujeto común de todas las formas– porque realiza objetivamente en la inteligencia divina todo aquello que responde a la definición del universal abstraido de las cosas, mientras que ésta no subsiste sino en la inteligencia humana, si es que un concepto puede subsistir en alguna parte.

En principio, Champeaux declaraba que la especie es la esencia misma de los individuos. Forzado a retirar esta tesis dirá que la especie es el sujeto universal al cual le adviene la forma de la individualidad, es decir, el uno que se encuentra en todos bajo la diversidad formal del número y de los accidentes. Después, a mitad de camino a la "indiferencia", se esfuerza en establecer que el uno incorporado es el indiferente que constituye la identidad de los individuos, sea en la especie, el género o la substancia. En fin, y en virtud del mismo principio, admite el uno inteligible como la causa inmediata –pero a la vez eterna y divina– de todo lo que aquí abajo posee el caracter de universalidad.

Hay muchas diferencias entre el sistema propuesto por Guillermo y el propuesto por Adelardo de Bath. En Champeaux la idea del uno es enunciada *a priori*, y realizada en el sentido de las cosas, tal y como ella es en la inteligencia, sin alguna crítica o comentario a cómo la inteligencia conoce la idea. En Adelardo, se procede siguiendo un método psicológico; se observa en la demostración el orden a través del cual se forman las ideas; se va de las nociones recogidas por los sentidos a las que la imaginación transmite a la razón, para declarar que la razón sólo conoce la verdad de las cosas en el entendimiento divino. Este último método será el preferido entre algunos de los maestros aristotélicos de la escuela realista en el siglo trece.

En la solución aportada por Adelardo de Bath se comienza el análisis a la manera de los nominalistas. Adelardo define el género y la especie como aquellos nombres de las cosas contenidas en ellos: tenía razón Aristóteles al decir que sólo existen en los individuos, pero esto no significa que no sean nada. Cada uno de los seres que vemos es –simultánea e idénticamente– individuo, especie y género, pero se lo ve como individuo, como especie o como género, según que el pensamiento los vea con mayor o menor penetración, y en esto tiene razón Platón, el conocimiento de un ser como individuo es el inferior de todos. Hace años decía Gilson que "Adelardo no busca ningún eclecticismo. No se hace la ilusión de que los adversarios con quienes se enfrenta puedan contradecirse y tener, al mismo tiempo, toda la razón; sino que sugiere la distinción de dos planos, en cada uno de los cuales sería verdadera cada una de las tesis opuestas. Ya vimos que Abelardo, lejos de rechazar por completo las Ideas, afirmaba su existencia en el pensamiento divino. Así, pues, se advierte cómo van preparándose, desde comienzos del XII, las síntesis cristianas del XIII, que se inspirarán en Aristóteles para interpretar el orden de lo sensible y en Platón para interpretar el orden de lo divino."[56]

Adelardo de Bath, como suele ocurrir con otros "intentos de síntesis superadoras" mucho más conocidos y más complejos (se los califique a éstos como "eclécticos" o no), no andaba muy alejado del "espíritu" que anima la raíz común y las sólidas diferencias del pensamiento de Platón y Aristóteles. Quizás conoció mejor a Platón, o se sentía ontológicamente más cercano a éste; pero, ciertamente, tanto su obra como su vida son un claro ejemplo de "actitud" aristotélica ante el mundo. Pues, su incansable esfuerzo por perseguir la estela del conocimiento científico y el trabajo de lecturas y traducciones del árabe legadas al mundo latino, se encuentran muy próximas a los esfuerzos recuperadores de la tradición que el estagirita intentó siglos atrás. Con certeza el conocimiento que poseía de Aristóteles distaba mucho del que le hubiese sido accesible unas décadas más tarde pero, tal vez, Aristóteles le era "conocido" de otro modo; de esa forma en que se convive con una tradición que pertenece al acervo propio de quienes, como era usual en aquellas épocas, vivían en una proximidad con los "príncipes" de la filosofía no tan erudita pero, ciertamente, tan controvertida como la actual.

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[56] E. Gilson, *La Filosofía en la Edad Media*, trad. por A. Pacios y S. Caballero, Madrid 1965, 277.

ARISTOTLE AND AVERROES ON METHOD IN THE MIDDLE AGES AND RENAISSANCE: THE “OXFORD GLOSS” TO THE *PHYSICS* AND PIETRO D’AFELTRO’S *EXPOSITIO PROEMII AVERROYS*

Charles Burnett and Andrew Mendelsohn

Introduction

Aristotle states his method of enquiry in natural science in the opening sentences of his *Physics*, of which one modern interpretation is the following:

> I Since understanding and knowing in every inquiry concerned with things having principles or causes or elements results from the knowledge of these (for we think that we know each thing when we know the first causes and the first principles and have reached the elements), clearly, in the science of nature too we should first try to determine what is the case with regard to the principles. II The natural way to proceed is from what is more known and clearer to us to what is by nature clearer and more known; for what is known to us and what is known without qualification are not the same. So we should proceed in this manner, namely, from what is less clear by nature, though clearer to us, to what is by its nature clearer and more known. III Now the things that are at first plain and clear to us are rather mingled, and it is later that their elements and principles become known to those who distinguish them. IV Consequently, in the case of each thing, we should proceed from its entirety to each of its constituents, for it is the whole that is more known by sensation; and a thing in its entirety, since it includes many constituents as parts, is a kind of a whole. V In a sense, a name is related to its formula in the same way, for a name signifies some whole without distinguishing its parts, as in the case of “a circle”; but its definition analyzes the whole into its constituents. Children, too, at first call every man “papa” and every woman “mama”, but later on they distinguish them.[1]

In the Middle Ages and the Renaissance this text was known primarily in the Greek–Latin translation of James of Venice, either in its older form—the *Translatio vetus*—or in a revision made in the second half of the thirteenth century by William of Moerbeke—the *Translatio nova*.[2] But, to interpret Aristotle's meaning, Latin readers from the 1230s onwards also consulted the Latin translation of Averroes' Large Commentary on the *Physics*, which is ascribed to Michael Scot, the emperor Frederick II's astrologer.[3] To his commentary Averroes added a Proemium which was translated by Theodore of Antioch, the court philosopher of Frederick II.[4]

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[1] *Physics*, 184a10-b14, tr. H. G. Apostle, Bloomington/London 1969.

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[2] Aristotle, *Physica. Translatio vetus*, ed. F. Bossier and J. Brams, *Aristoteles Latinus*, VII.1, 2 fascicles, Leiden/New York 1990. The first section of the *Physics* in the various translations current in the Middle Ages (except for the *Translatio Scoti*, on which see below) are conveniently set out in G. Lacombe, *Aristoteles Latinus. Codices*, vol. 1, Rome 1939, 125-8.

[3] The earliest reference to Averroes' text is in Robert Grosseteste's commentary on Aristotle's *Physics*, written between 1228 and 1232 (see the edition by R. C. Dales, Boulder 1963, xiv). The ascription to Michael Scot is supported by most scholars but (apparently) by no manuscript: see G. Lacombe, *Aristoteles Latinus. Codices*, 1, Rome 1939, 104. An edition of this version is being prepared by Horst Schmieja (see H. Schmieja, "Drei Prologe im grossen Physikkommentar des Averroes?" in: A. Zimmermann and G. Vuillemin-Diem (eds.), *Aristotelisches Erbe im arabisch-lateinischen Mittelalter* (Miscellanea Mediaevalia 18), Berlin/New York 1986, 175-89). The Arabic original of the Large Commentary has not been identified. A Hebrew translation of this Large Commentary is extant. The Middle Commentary exists in Arabic, Hebrew, and a Latin translation from the Hebrew, by Jacob Mantino, of the first three books. The Epitome (or Short Commentary) is extant in Arabic and Hebrew, and the Arabic text has been edited and translated into Spanish by Josep Puig, *Averroes, Epitome in Physicorum Libros* (Corpus Commentariorum Averrois in Aristotelem A 20) Madrid 1983-7. An English summary and analysis of all three texts of Averroes and of a "supercommentary" on the Epitome by Gersonides, is given by P. Lettinck in *Aristotle's* Physics *and its Reception in the Arabic World*, Leiden, 1994. For the general context, see C. B. Schmitt, "Renaissance Averroism Studied through the Venetian Editions of Aristotle-Averroes" in: *Convegno internazionale, l'Averroismo in Italia*, Rome 1979, 121-42, and N. W. Gilbert, *Renaissance Concepts of Method*, New York 1960. Although Gilbert writes "Averroes' commentary on the introduction to the *Physics* was the chief text upon which the Italian Aristotelians relied in their discussion of order and method" (166) he does not cite Averroes directly, but only provides succinct accounts of interpretations derivative from Averroes in Ludovicus Buccaferrea (ca. 1482-1545), Jacopo Zabarella (1533-89), Francesco Piccolomini (1520-1604) and Jacobus Mazzonius (1548-98); see 165-79; see also S. Donati, "*Physica* I, 1: L'interpretazione dei commentatori inglesi della *Translatio vetus* e la loro recezione del commento di Averroe", in: *Medioevo* 21 (1995), 75-225.

[4] MS Erfurt, Amplonian, Fol. 352, fol. 104v: "Istum (sic!) est prohemium commenti A. super libro Physicorum Aristotilis, quod transtulit magister Theodorus ... rogatus scolarium qui erant Padue" (quoted in *Aristoteles Latinus. Codices*, I:104); see C. Burnett, "Master Theodore, Frederick II's Philosopher," in: *Frederico II e le nuove culture*, Atti del XXXI convegno storico internazionale, Todi 9-12

The lemmata in Averroes' commentary form a complete text of Aristotle's *Physics*. This Arabic–Latin version of the *Physics*, which never occurs apart from the Commentary, is therefore called the *Translatio Scoti*. Moreover, in the first half of the sixteenth century Jacob Mantino provided another translation of Averroes' Proemium, this time from the Hebrew.[5] Thus, in the fourth volume of the Giunta edition of *Aristotelis Opera cum Averrois Commentariis*, published in Venice between 1562 and 1574, Averroes' Proemium is printed in double columns, the left column being the translation of Theodore of Antioch (called "antiqua translatio"), the right one being that of Mantino. Then, for each of the lemmata in Averroes' commentary, two translations are given: the first being William of Moerbeke's revision of James of Venice's Greek–Latin version; the second (printed in italics) being Michael Scot's translation of the lemmata within the commentary.

Averroes used the opportunity of commenting on the opening section of the *Physics* to establish the methods of enquiry or proof. In the Latin translations of the Large Commentary he defines them thus:

> When [Aristotle] made it clear that it was necessary for natural <science> to dispense knowledge of causes and elements, he adumbrated the way ("via") leading to ("inducentem") the knowledge of the causes of natural things and the

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October 1994, Spoleto 1995, 225-85. This Proemium is an introduction to Aristotle's *Physics* in as much as it is the first book of natural science, and hence can be regarded as an introduction to the whole of Aristotle's works on natural science and as not strictly tied to the *Physics*. The Proemium shares material not only with a prologue to the eighth book of the *Physics* in the Large Commentary (see Schmieja, as note 3), but also with one of the two prologues found in manuscripts of the Arabic text of the Epitome; see J. Puig, "Tres manuscritos del Epítome de la Física de Averroes en El Cairo," *Anaquel de estudios árabes* 2 (1991) 131-7. However, neither of the other prologues discusses method. Note that, confusingly, the first chapter of Aristotle's *Physics* is also sometimes called the "Proemium" (e.g., by Thomas Aquinas) and it is *this* proemium that is the subject of G. J. McMahan, "The Proemium to the Physics of Aristotle," in: *Laval théologique et philosophique* 13 (1957), 9-57. Unfortunately we were unable to use the fine edition and translation of "The Hebrew translation of Averroes' Prooemium to his *Long Commentary on Aristotle's Physics*," made by Steven Harvey in *Proceedings of the Americal Academy for Jewish Research* 52 (1985), 55-84.

[5] For Mantino (d. 1549) see H. Derenbourg, "Leon Africain et Jacob Mantino," in: *Revue des Études Juives* 7 (1883) 283-5; D. Kaufmann, "Jacob Mantino: une page de l'histoire de la Renaissance," in: ibid. 27 (1893) 30-60 and 207-38; R. Hissette, "Guillaume de Luna—Jacob Anatoli—Jacob Mantinus: A propos du commentaire moyen d'Averroès sur le 'De interpretatione'," in: *Bulletin de philosophie médiévale* 32 (1990), 142-58.

> nature of the demonstrations dispensing the causes of natural things, and said "and the way leading to them", that is, the way leading to the knowledge of the causes of natural things, "is from propositions taken from things which are later in existence, which are more known and more visible to us, to conclusions which are prior in existence, which are more known and more visible to nature and more hidden from us", *and this is the method of demonstrations which is called "the sign"* ("et est modus demonstrationum qui dicitur signum")...
> Because, therefore, we naturally proceed from what is known to us to what is unknown, if it happens that what is known to us is known to nature, then the demonstrations given in this science will be *demonstrations of cause and existence* ("demonstrationes causae et esse").
> And if it happens that what is known to us is not known to nature— <these are things> which are not prior in existence but later—, then the demonstrations given in this science will be from the number of signs ("demonstrationes datae in hac scientia erunt de numero signorum"), not *demonstrations in-a-simple-sense* ("demonstrationes simpliciter").[6]

Averroes summarises these kinds of demonstration when he comes to the heading "way of teaching" ("via doctrinae") in the Proemium. This is translated by Theodore of Antioch in the following way:

> Via doctrinae huius libri sunt species doctrinae usitatae in hac scientia. Et sunt modi omnium disciplinarum, scilicet demonstratio signi et demonstratio causae et demonstratio simpliciter, quamvis signum et causa sint plus usitata in hac scientia; et aliquando est usitata demonstratio simpliciter.
>
> The way of teaching in this book follows the species of teaching used in this science. And they are the kinds belonging to all disciplines: i.e., demonstration of the sign and demonstration of the cause and demonstration *simpliciter*, although sign and cause are more used in this science; and sometimes demonstration *simpliciter* is used.[7]

Jacob Mantino gives a more ample translation of the same passage, specifying that there are three kinds of demonstration and giving the example of mathematics:

> Modus autem doctrinae qui in eo fit est ex generibus doctrinae quae in hac scientia fieri solent, qui quidem sunt modi omnium doctrinarum trium generum demonstrationum, nempe signorum, seu demonstrationum quod est, et demonstrationum propter quid, necnon demonstrationum absolutarum vel simpliciter, licet in hac arte maior pars demonstrationum que in ea fiunt, sint demonstrationes quod est et propter quid. Raro enim fiunt in ea demonstra-

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[6] Giunta edition, vol. IV (= *Aristotelis de physico auditu libri octo cum Averrois Cordubensis variis in eosdem commentariis*, Venice 1562), fols 6K-7A, reproduced below, 68-70. Other texts in which Averroes discusses method in this commentary are bk. ii, comm. 22 and bk. viii, comm. 58.

[7] Giunta edition, vol. IV, fol. 4B.

> tiones absolutae, contra id quod fit in ipsis Mathematicis in quibus scilicet fiunt ut plurimum demonstrationes simpliciter et absolute.

> The method of teaching which is practised in [this book] belongs to the kinds of teaching which are customarily practised in this science: the methods of all teachings are of three kinds of demonstrations, i.e., of signs (or demonstrations *quia*), and demonstrations *propter-quid*, and demonstrations in an absolute sense or *simpliciter*, although in this art the greater part of demonstrations which are practised are demonstrations *quia* and *propter-quid*. For rarely are demonstrations in an absolute sense practised in it, in contrast to that which is done in the mathematical <sciences> themselves, in which, namely, for the most part, demonstrations *simpliciter* and in an absolute sense are practised.

It is now impossible to be sure of what the original Arabic had in these contexts, but we can compare the Arabic text of the Epitome in which Averroes provides a similar account of the kinds of demonstration:

> And it has been said in the art of Logic[8] that the principles (mabādīʾ) of learning in the arts are of two kinds. One of the two is if what is prior in knowledge to us is prior in existence, as occurs in the matter of mathematics, and the demonstrations composed from these are demonstrations in an absolute sense (burāhīn al-muṭlaqa). And the second is if what is prior to us in knowledge is later in existence, as occurs generally in this science, and the kinds of demonstration composed from these later principles are called "signs" (dālāʾil).[9]

Moreover we can compare the Hebrew translation of the Proemium. Hebrew manuscripts of the Large Commentary, translated from Arabic in the early fourteenth century by Kalonymos ben Kalonymos (b. 1286), are relatively rare; those including the Proemium rarer still. Moritz Steinschneider in his bibliography of 1893 listed only three manuscripts which include the Proemium, two in the Bibliothèque Nationale and one in the Bodleian, though some which he did not see or which have since been discovered may also contain the Proemium.[10] The Bodleian manuscript, Steinschneider implies,[11] is unlikely to have been the manuscript used by Mantino for his translation of the Proemium from Hebrew into Latin. We were able to compare the Paris manuscripts, which are catalogued as fifteenth-century copies of Kalonymos' translation, with the medieval and Renaissance Latin versions of the Proemium. At a number of places in the text where Mantino's Latin differs considerably from Theodore's, the Paris manuscripts agree with Mantino.[12] However, the Paris manuscripts differ from one another precisely in the passage on the *via doctrinae* (Hebrew: אופן הלמוד). Only when the manuscripts are collated does the Hebrew fit Mantino's translation.

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[8] Aristotle, *Posterior Analytics*, 71b34-72a6.

[9] *Epitome*, ed. J. Puig (as note 3), 9, lines 7-12.

[10] M. Steinschneider, *Die hebräischen Übersetzungen des Mittelalters und die Juden als Dolmetscher*, Berlin 1893, 122-3. We thank Tzvi Langermann for information from the card catalogue of the Institute of Microfilmed Hebrew Manuscripts at the Jewish National and University Library in Jerusalem.

[11] Steinschneider (as note 10), 123, n. 104.

The difference between the two manuscripts and their relation to the medieval and Renaissance Latin versions of the Proemium bears elaboration, since, as Horst Schmieja has remarked,[13] investigation of the Hebrew tradition must at present make up for the lack of an Arabic manuscript of Averroes' Large Commentary. The passage on method as Mantino represented it, consists of three sentences all ending in the phrase "absolute demonstrations" (Hebrew: המופתים המוחלתים). The length of the sentences is such that this distinctive phrase occurs at approximately the same place in consecutive lines in the Hebrew manuscripts. This sequence seems to have invited elisions in copying. Hebr. 884 lacks the third sentence in the passage, on the special case of mathematics. It has been added in the left margin by a later hand. Hebr. 883 lacks the second sentence in the passage, on the relative uses of the three kinds of demonstration in natural science. In this case, the elision results in a *non sequitur*, which helps to confirm that the variants were produced through errors in copying. Strikingly, two different scholars or scribes working in two different parts of the world—Hebr. 883 appears to be in a Sephardic hand; Hebr. 884, in an Italian hand—made nearly the same copying mistake in the same passage.

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[12] BN MS Hebr. 883 and Hebr. 884. Besides the variant occuring in both Mantino and Hebr. 884 as noted by Steinschneider (as note 10; Hebr. 883 is illegible here), a rough comparison between Mantino's text and both Paris manuscripts reveals a number of correspondences. For example, at Giunta edition, vol. IV, fols 4M-5D, Mantino gives a long paragraph including a reference to the books of Plato, which is not found in Theodore of Antioch's translation; this agrees with Hebr. 883, fol. 2v, and Hebr. 884, fol. 2v. And at fol. 5E-F, Mantino closes his version of the Proemium with two paragraphs, lacking in Theodore, on the organization of the first book of the *Physics*; this agrees with Hebr. 883, fol. 2v, and Hebr. 884, fol. 3r.

[13] Schmieja, "Drei Prologe" (as note 3), 189.

Several conclusions would seem to follow. First, it is unlikely that Mantino worked from either Hebr. 883 or Hebr. 884 alone, but instead from both or from a prior manuscript with a complete version of the passage on method. This hypothetical prior manuscript would read as follows:[14]

> [1] אופן הלמוד הנעשה בו הוא ממיני הלמוד הנעשים בזאת
> החכמה והם צדדי כל הלמודים ממיני המופתים השלשה ר״ל
> הראיות ומופתי הסבות והמופתים המוחלטים: [2] ואם היו הראיות
> והסבות הם אשר נשתמש בם ברוב זאת המלאכה וככר יעשו בה
> על המעט המופתים המוחלטים: [3] וזה בחלוקי הענין בלמודי
> ר״ל שהם יעשו לעולם על הרוב המופתים המוחלטים:

> [1] The method of teaching which is practised in [this book] is from the kinds of teaching practised in this science, and they belong to all the teachings from the three kinds of demonstration: i.e., [demonstrations of] the signs [הראיות] and demonstrations of the causes and absolute demonstrations. [2] And if there are [demonstrations of] the signs or the causes, they are those that we apply in the major part of this art, and similarly a few absolute demonstrations are applied in it. [3] And this is different in mathematics [בלמודי], i.e., for the most part it always uses absolute demonstrations.

A second conclusion suggests the usefulness of the Hebrew tradition of Averroes' Large Commentary for solving problems in the Latin one. The Hebrew variants could explain why the example of mathematics does not appear in the old Latin translation of the Proemium by Theodore of Antioch as it is printed in the Giunta edition: for the same error in copying could as easily have happened in the Arabic or Latin transmissions of this sequence of three sentences all ending in the phrase "absolute demonstration(s)" as happened at least twice independently in the Hebrew tradition.

Mantino's version of the passage on method in the Proemium differs in one other fundamental way from Theodore's. Mantino uses the terms "propter quid" and "quod est" for demonstration of cause and demonstration of sign respectively. In the case of demonstration *propter quid*, he drops the term "causae" altogether. Here, the Paris Hebrew manuscripts agree with Theodore, containing no expressions for *propter*

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[14] Sentences [1] and [3] from Hebr. 883, fol. 2r; sentences [1] and [2] from Hebr. 884, fol. 2v. It is at least possible that Mantino worked from Hebr. 884 alone, assuming that the marginal addition was early enough and that he chose to include it in his translation.

quid and *quod est* (or *quia*). Mantino has apparently added these from his knowledge of method discussions in Latin. It is thus arguable that the original Arabic of Averroes' Proemium, like the Hebrew, did not include equivalents of these terms as they appeared in Arabic translations of and commentaries on the *Posterior Analytics*. And, finally, Mantino's sixteenth-century Latin version of the passage on method in the Proemium, though advertised by the Giunta editors as improved and corrected from the Hebrew,[15] was thus also edited according to the Latin Aristotelian tradition itself.[16]

The discrepancy between three kinds of demonstration in the Proemium, two or three kinds in the Large Commentary, and two kinds in Aristotle (as reported in the Epitome) did not pass unnoticed, as we shall see. However, it is not our intention to provide an analysis of Averroes' texts here. Rather, we would like to consider how they were used and interpreted in the Middle Ages and the Renaissance. First we edit the relevant portion of the " Oxford gloss" to the *Translatio vetus* of the *Physics,* which represents the teaching in the arts faculty at Oxford in the late thirteenth century. The second text is an exposition of the Proemium by a teacher of arts and medicine in the university of Naples—Pietro d'Afeltro—in the early sixteenth century. In addition to illustrating teaching on method, the juxtaposition of these two texts may help to assess the continuity of the Averroistic commentary on Aristotle from the Middle Ages to the Renaissance.[17]

I

What we call the "Oxford gloss" is the set of glosses that has been identified in several English manuscripts of the *Translatio vetus*. The recent editors of the *Translatio vetus* have stated that "tout donne à croire que bien vite il s'est constitué à Oxford une chaîne de gloses scolaires comprenant des extraits d'une 'autre traduction' (*alia translatio*) et des explications marginales et interlinéaires, toutes puisées à [la traduction de Michel Scot] et à celle du commentaire d'Averroès." They have found this "glose scolaire" in MSS London, British Library, Harley 3487, Royal 12.G.III and 12.G.V and Cambridge, Gonville and Caius College, 506/384, and, in a reduced form, in London, British Library, Royal 12.G.II, Cambridge, University Library, Ee.II.31, Durham Cathedral, Chapter Library, C.III.17, Oxford, Corpus Christi College, 111 and 114, and Vatican City, Biblioteca apostolica Vaticana, Urb. lat. 206 (first glossator).[18] All these manuscripts contain the Corpus vetustius of Aristotle's works on natural science, including the *Physics* in the *Translatio vetus.* These glosses have an important bearing on the development of scholastic commentary on these works at Oxford, from Alfred of Sareshel (who appears to be the pioneer), through Adam of Buckfield and "R. de Stanington", to the scholars of the fourteenth century.[19]

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[15] Giunta edition, vol. IV, fol. 1; and general preface to the Giunta edition of 1550-2, quoted in Schmitt, "Renaissance Averroism" (as note 3), 139, n. 79.

[16] Mantino translated somewhat liberally in other contexts as well; see Hissette, "Guillaume de Luna—Jacob Anatoli—Jacob Mantinus" (as note 6).

[17] Cf. Schmitt, "Renaissance Averroism," (as note 3), 125: "One way in which they [the commentaries of Averroes] can be viewed, though to the best of my knowledge they have not been, is in relation to other medieval traditions of exposition."

The following edition of the glosses is based on MSS London, British Library, Harley 3487 (Ha), Royal 12.G.II (Lt), 12.G.III (Lk) and 12.G.V (Lv).[20] The sigla of the MSS which contain the gloss are given on each occasion and the variants are listed according to the priority Lv, Ha, Lk and Lt.[21] To demonstrate how the Oxford gloss makes a selection from Averroes' text, the latter is reproduced in the left column from the Giunta edition with the folios and the divisions of the folios marked. The Giunta text of Averroes is not the same as that of the thirteenth century, as Schmieja makes clear. But, apart from its convenience (until Schmieja's edition appears), it serves the purpose of showing the form of Averroes' text that was being read by Renaissance scholars. For each lemma from

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[18] See Bossier and Brams, Aristoteles Latinus (as note 2), VII.1, lv.

[19] See D. A. Callus, "Introduction of Aristotelian Learning to Oxford," in: *Proceedings of the British Academy* 29 (1943), 229-81. The parallels with Adam of Buckfield's commentary on the *Physics* as it appears in London, Wellcome Historical Medical Library, MS 3, are noted below. For other parallels we are grateful to Silvia Donati. See also S. Donati, "Per lo studio dei commenti alla *Fisica* del XIII secolo. I: Commenti di probabile origine inglese degli anni 1250-1270 ca.," in: *Documenti e studi sulla tradizione filosofica medievale* II.2 (1991), 362-441.

[20] We use the sigla adopted by Bossier and Brams. These manuscripts do not include the Proemium, which was probably never covered by the Oxford gloss.

[21] I.e., when Lv has the gloss it is used as the base manuscript; if the gloss is absent in Lv, the next MS in priority becomes the base manuscript.

Aristotle's text we give the *Translatio vetus* version as printed in Aristoteles Latinus, with the major variants from MSS LvHaLkLt, followed by the *Translatio Scoti* as printed in the Giunta edition. The chapter titles are those added by Hieronymus Bagolinus in the Giunta edition. The *textus* into which Averroes divided Aristotle's work are numbered with capital Roman numerals. Further subdivisions are our own. The punctuation is our own. The lemmata are given capital Roman numerals and the glosses are numbered in one sequence with Arabic numerals.

Summa Prima

Cap. 1: De proposito huius scientiae

I. *Translatio vetus*: Quoniam quidem intelligere et scire contingit circa omnes scientias quarum sunt principia aut cause aut elementa, ex horum cognitione (tunc enim opinamur cognoscere unumquodque cum causas cognoscamus primas et principia prima et usque elementa), manifestum est de natura scientie temptandum prius determinare que circa principia sunt.

opinamur] arbitramur Ha

Translatio Scoti: Quoniam dispositio certitudinis et scientiae in omnibus viis habentibus principia aut causas aut elementa non acquiritur nisi ex cognitione istorum (credimus enim in unaquaque rerum ipsam scire cum sciverimus causas eius simplices et prima principia eius donec perveniamus ad elementa eius) manifestum est quod in scientia naturali etiam oportet primo quaerere determinationem principiorum eius.

1 Incoepit hunc librum a causa [5M] propter quam fuit consyderatio huius scientiae in cognitione causarum rerum naturalium, et dixit: *Quoniam dispositio*, id est, quia declaratum est in Posterioribus [bk.1, ch. 2] quod dispositio scientiae certae in omnibus artibus demonstrativis, considerantibus de rebus

	habentibus causas vel unam quatuor causarum aut plures una aut omnes, non acquiritur nisi ex cognitione causarum.	
2	Et non intendebat per scientiam et certitudinem synonyma, quoniam nomina synonyma non usitantur in scientia et doctrina demonstrativa, [6A] sed intendebat dispositionem scientiae certae. Scientiae enim certa est scientia perfecta. Scientia enim alia est perfecta et est illa quae est per causam; alia est imperfecta et est illa quae est sine causa.	*Quoniam quidem,* alia translatio *quoniam dispositio certitudinis et scientie in omnibus viis.* Commentator: Et non intendebat per certitudinem et scientiam nomina sinonoma quoniam nomina sinonoma non usitantur in scientia demonstrativa, sed intendebat dispositionem scientie certe. Scientia enim alia est perfecta et est illa que est per causam; et quedam scientia est imperfecta et est illa que est sine causa. LkHaLv. Quoniam quidem] HaLk om.; et scientie...Commentator] Ha om.; in omnibus viis] Lk omit; per certitudinem...sine causa] Ha omits; nomina *bis* Lk omit; scientia] doctrina Lk; scientia...que] et est scientia perfecta et causalis et Lk; et est illa que est per causam] Lv repeats; est illa...sine causa] illa est sine causa Lk.
3	Et intendebat per vias artes speculativas, quae dicuntur vie quia consyderans in eis vadit ex determinatis rebus ad res indeterminatas per res determinatas.	*In omnibus viis.* Et intendebat per vias artes speculativas que dicuntur vie quia considerans de eis vadit a rebus terminatis (sic!) ad res terminatas Lv(→9) speculativas demonstrativas secundum Commentatorem. Lt
4	Et dixit *habentibus principia aut causas aut elementa* quia artium speculativarum aut suarum partium sunt quaedam quae consyderant de rebus simplicibus carentibus	*aut elementa.* quoad formalem et materialem sicut exponit Commentator. Aliter tamen exponit Commentator ista nomina ibi *cum causas cognoscimus* et dicit *circa*

	principiis, et haec est dispositio scientiae consyderantis de [6B] propriis principiis et primis cuiuslibet artis vel entis. Et dixit *principia aut causas aut elementa* propter diversitatem modorum quatuor causarum.	*omnes scientias*: quia artium speculativarum aut suarum partium sunt quedam que considerant de rebus simplicibus carentibus principiis et hec est dispositio scientie considerantis de primis principiis. Lv
5	Et intendebat per *principia* in hoc loco causas agentes et moventes, et per *causas* fines, et per *elementa* causas, que sunt partes rei, scilicet materiam et formam.	*principia.* Commentator: Et intendebat per principia in hoc loco causas agentes et moventes, et per causas fines, et per elementa causas que sunt partes rei, scilicet materiam et formam. Lv(→ 7) Principiorum causarum et elementorum. Commentator. Et dixit *principia cause elementa propter diversitatem.* Lt
6	Et utitur hoc nomine *principium* proprie et similiter hoc nomine *causa* quia sunt nomina synonyma, cum usitentur communiter.	
7	Et sic, ut mihi videtur, exposuit Alexander. Et intendebat Aristoteles per hunc sermonem docere quod non omnes artes consyderant de omnibus causis, sed quaedam [6C] consyderant de causa formali tantum, scilicet Mathematice; et quaedam de tribus causis, scilicet efficiente, formali et fine, et est scientia Divina, et quedam de quatuor causis, et est scientia Naturalis.	Et paulo post: Et sicut mihi videtur, intendit Aristoteles per hunc sermonem docere quod non omnes artes considerant de omnibus causis, sed quedam considerant de causa formali tantum, scilicet mathematice; et quedam de tribus, scilicet forma, motore et fine, scilicet scientia divina; et quedam de quattuor causis, et est naturalis. Lv(→ 12)HaLk. Et paulo ... docere] Divus Arist. intendit per hunc sermonem docere Ha, Commentator: et intendit Aristoteles

8 Et quia hoc non fuit manifestum in hoc loco, induxit sermonem in formam dubitationis et dicit *habentibus principia aut causis aut elementa*, id est, quoniam idem sequitur si ponatur quod illae res habeant principia agentia aut finalia aut elementaria, aut omnia (et impossibile est ut haec coniunctio) aut sit sicut copulativa. Nam dispositio certae scientiae in[6D]venitur in rebus habentibus causas quasdam per scientiam illarum causarum, sicut invenitur in habentibus omnes causas. Et, cum posuit hanc propositionem, induxit testimonium ad verificandum illam, quod fere induxit in Posterioribus Analyticis [bk.1, ch.2], et dicit *credimus enim in unaquaque rerum* etc., et signum eius quod diximus quod dispositio scientiae certae de aliquo non acquiritur nisi ex cognitione causae eius,

9 quoniam omnis qui dicit se scire aliquid, non dicit hoc nisi quoniam scivit illud per suas omnes causas propinquas et remotas. Et hoc invenitur in omni qui [6E] aliquid scit in veritate aut secundum existimationem. Et quod in ista propositione conveniunt omnes consyderantes, adeo quod etiam Sophistae, ut dixit in Posterioribus.

per hunc sermonem dicere Lk; considerant2] Ha om.; tribus] tribus causis Ha; scilicet] ut Ha; et est naturalis] ut est scientia nat. Ha, scilicet naturalis scientia Lk

causas. Commentator: quoniam omnis qui dicit se scire aliquid non dicit hoc nisi quando sciverit illud per omnes causas suas propinquas et remotas, et hoc sive sciverit illud secundum estimationem sive secundum veritatem.

LvHaLk. causas] Ha om.; causas suas] Lk transp.; sciverit illud] HaLk om.

vel sic dicit *opinamur* com-

		niter propter scientes et propter non scientes opinantes tamen se scire. Et huic consonat Commentator ibi *cum* etc. Lk
		sic exponit Commentator hic. Aliter tamen exponit Commentator ista nomina inferius ibi *cum causas cognoscimus* Lk
10	Deinde dicit: *cum sciverimus causas eius simplices*, et intendit, ut mihi videtur, causas existentes in re, primas non compositas, et sunt prima materia et ultima forma. Quae enim sunt praeter primam materiam et ultimam formam cuiuslibet rerum naturalium sunt materiae compositae et formae compositae.	Et paulo post: Et intendit, ut videtur, per *causas primas* causas existentes in re primas non compositas, et sunt prima materia et ultima forma. Que enim sunt preter primam materiam et ultimam formam cuiuslibet rerum naturalium sunt materie composite et forme composite. Lv(→11)HaLk. Paulo post ... existentes] intendit ut videtur per quas primas causas existentes Ha, intendit per causas Lk; primas non compositas] HaLk om.
11	Deinde dicit *et prima principia*, et intendit, ut videtur, per *prima principia*, primas causas quae sunt extra rem, scilicet [6F] primum agens et ultimum finem omnium rerum.	*Principia.* Commentator: per principia prima intendit causas primas que sunt extra rem, scilicet primum agens et ultimum finem omnium rerum. Lv(→4)HaLk(→12). Principia. Commentator] Ha om.
12	Deinde dicit *donec perveniamus ad elementa eius*, et intendit hic per elementa causas existentes in re propinquas et essentiales. Et innuit per hoc quod dixit quod doctrina ordinata est incipere	*et usque ad elementa.* Commentator: per elementa intendit hic causas existentes in re propinquas et essentiales. Et sic utitur hiis nominibus hic aliter quam prius. Et aliter exponit Commentator ista

a cognitione causarum primarum rei cognoscendae perfectae, deinde intendere ad cognitionem aliarum causarum remotarum secundum ordinem donec perveniamus ad causas propinquas. Et secundum hoc utitur hoc nomine *causa et elementum* alio modo ab eo quo usus est illic prius, secundum suum morem in habendo modicam solicitudinem de nominibus [6G].

13 Et cum posuit hanc maiorem propositionem in hoc sermone dicentem quod scientia certa de rebus habentibus causas et elementa non acquiritur nisi ex cognitione causarum et elementorum eorum, dimisit minorem propositionem et induxit conclusionem quam intendit per hunc sermonem, et dixit: *manifestum est quod in scientia naturali*, etc., id est, manifestum est quoniam ex hoc sequitur quod qui vult largiri scientiam de natura oportet ipsum prius quaerere determinationem causarum rerum naturalium habentium causas et elementa. Et [6H] ille sermo componitur sic: Omnia naturalia habent principia, causas et elementa. Sed habentia causas, principia et elementa non sciuntur nisi ex cognitione causarum et elementorum. Ergo omnia naturalia non sciuntur nisi ex cognitione suarum causarum et elementorum.

nomina in undecimo Philosophie Prime.

LvHaLk. *et usque*...Commentator] HaLk om.; hiis] istis Lk; hic] HaLk om.; Et aliter...Prime] LvHa om

Post ostendit quod oportet incipere a consideratione(?) principiorum et quod oportet incipere a principiis universalibus ibi *Innata est.* Post ergo ponit talem rationem in omnibus scientiis quarum sunt principia aut cause aut elementa. Intellectus et scientia procedit ex cognitione principiorum et causarum et elementorum. Sed scientia que est de natura habet principia et elementa et causas. Ergo in ea oportet incipere a determinatione principiorum.

Lv(manus secunda). Cf. Thomas Aquinas, *In Physicam*, I, lect. 1, ed. Marietti, Turin and Rome, p. 4, no. 5.

et de natura, id est secundum quod exigit natura scientie vel sic: id est, in scientia de natura et sic per hoc quod dicit *natura* innuit de quo est intentio. Unde alia translatio *manifestum est quod in scientia naturali oportet primo querere determinationem principiorum eius.*

Lv(→15)

Other glosses:
vel aliter secundum Commentatorem, *intelligere* quantum ad dispositionem scientie certe, que est per causam certam, et *scire* quantum ad simplicem cognicionem minus certam. Dicitur etiam quod dicit *intelligere* ad differentiam cognitionis sensitive que non est per causam, vel, secundum quosdam, ad differentiam eius quod est scire ex opinione.

LvHa. Univ....minus certam] Lv om.; que non est per causam] Ha om. Cf. Adam of Buckfield's commentary.

Intelligere potest dicere quantum ad principia et *scire* quantum ad conclusiones et intendit per hec duo scire certitudinaliter et perfecte.

HaLt

Id est secundum quod exigit natura scientie vel sic: in scientia de natura et sic per hoc quod dicit natura innuit de quo est intentio.

Ha

Cap. 2: De generibus demonstrationum quae in hac scientia fiunt.

II. *Translatio vetus*: Innata autem est ex notioribus nobis via et certioribus in certiora nature et notiora; non enim eadem nobisque nota et simpliciter. Unde quidem necesse est modum hunc producere ex incertioribus nature nobis autem certioribus in certiora nature et notiora.

non enim eadem nobisque nota] non enim et eadem nobis que nota sunt Lv, non enim que nobis eadem nota sunt Ha, non enim eadem nobis que et simpliciter Lt; modum hunc producere] secundum hunc modum cedere Lv, secundum hunc procedere HaLt (post corr.); incertioribus] innocioribus Lt

Translatio Scoti: Et via ad illa est de rebus notioribus et manifestioribus apud nos ad res quae sunt manifestiores in natura. Illa enim quae sunt cognita apud nos non sunt illa quae sunt cognita simpliciter. Et ideo oportet nos ire per hanc viam et venire de rebus quae latentiores sunt apud naturam et manifestiores apud nos ad res quae sunt manifestiores et notiores apud naturam.

14 Cum declaravit quod oportet Naturalem largiri cognitionem causarum et elementorum, incoepit declarare viam inducentem ad cognitionem causarum rerum naturalium et naturam demonstrationum

largientium causas rerum naturalium, [6L] et dicit: *Et via ad illa*, id est, via inducens ad cognitionem causarum rerum naturalium, est de propositionibus acceptis ex rebus posterioribus in esse, quae sunt notiores et manifestiores apud nos, ad conclusiones priores in esse, quae sunt notiores et manifestiores apud naturam et latentiores apud nos. Et est modus demonstrationum qui dicitur signum.

15 Et cum declaravit naturam demonstrationis qua utitur hic, reddit causam et dixit: *illa enim quae sunt cognita apud nos* etc., id est, et causa in hoc quod via [6M] per quam itur in hac scientia debet esse a rebus posterioribus in esse ad res priores in esse, est quia illa quae sunt cognita apud nos in rebus naturalibus non sunt illa quae sunt cognita simpliciter, id est naturaliter, quod est contrarium in Mathematicis. Illa enim quae sunt cognita in illis simpliciter et sunt causae priores in esse, sunt cognita apud nos.

16 Quia igitur naturaliter procedimus de scito apud nos ad ignotum, si contigerit ut notum apud nos sit notum apud naturam, tunc demonstratio[7A]nes datae in hac scientia erunt demonstrationes causae et esse. Et si contigerit ut nota apud nos non sint nota apud naturam, quae non sunt priora in esse sed posteriora,

via ducens ad cognitionem causarum rerum naturalium Lt

Non enim et eadem nobis. Commentator: Et causa in hoc est quod via secundum quam itur in hac scientia debet esse a rebus posterioribus in esse ad priores, est quia illa que sunt cognita in rebus naturalibus apud nos non sunt illa que sunt cognita simpliciter, quod est contrarium in mathematicis. Illa enim que sunt cognita in illis simpliciter et sunt illa que sunt cause priores in esse, sunt cognita apud nos.

Lv(→20)Lk. *Non enim* … mathematicis] secundum enim Commentatorem contrarium accidit in mathematicis Lk tunc demonstrationes datae in hac scientia erunt de numero signorum, non demonstrationes simpliciter. Et cum notificavit qod via in hac scientia est incipere a rebus notioribus apud nos et intendere ad res notas apud naturam et ignotas apud nos, et quod impossibile est aliter in hac scientia incedere, incepit declarare quod per hanc viam oportet in hoc libro ire, scilicet quod oportet ipsum consyderare de hoc quod est de rebus cognitis apud nos, procedendo ad res [7B] cognitas apud naturam quae sunt causae quaesitae, et dicit: *Et ideo oportet nos* etc. Deinde demonstravit quae sint illa quae sunt cognita apud nos et latentiora apud naturam, et quae sunt illa quae sunt cognitiora apud naturam et ignotiora apud nos.

Other glosses:

Nota quod duobus modis sunt aliqua notiora nobis. Aliquando enim incipit cognitio nostra a sensu et terminatur ad intellectum, et secundum hoc sunt singularia nociora nobis, universalia autem non. Incipientibus autem cognitionem nostram econtrario nociora sunt universalia. Similiter duobus modis sunt aliqua nociora nature. Nature enim producenti singularia in esse, nociora sunt universalia eo quod natura non intendit producere in esse hunc hominem qua (?) hominem. Nature vero secundum quod est principium movendi secundum omnes species motus nociora sunt singularia quia sola singularia omni motu moventur non tamen omnia. Unde quandoque sunt singularia nociora nature, quandoque universalia. Sic solvitur omnis contrareitas.

Lt

III. *Translatio vetus*: Sunt autem nobis primum manifesta et certa que confusa magis, posterius autem ex his fiunt nota elementa et principia dividentibus hec.

fiunt nota] notiora sunt Lv

Translatio Scoti: Et illa quae primo sunt apud nos evidentia et manifesta sunt mixta, scilicet composita proprie, deinde in postremo efficiuntur nobis ex istis elementa et principia manifesta.

17 Dicit et illa quae sunt cognita apud nos primo de rebus naturalibus sunt composita causata ab elementis, et illa quae sunt ignota apud nos naturaliter sunt causae compositorum. Sed possibile est ex rebus compositis, id est ex consequentibus earum, cognoscere [7D] causas, adeo quod ex hoc erunt notae illae causae ex quibus componuntur. Causae autem sunt notiores apud naturam, quia natura facit composita ex causis. Unde videtur quod causae sunt notiores apud illam. Sicut est dispositio in rebus artificialibus cum artifice, scilicet quoniam causae sunt cognitiores apud illum. Si igitur nos ageremus res naturales, tunc causae essent notiores apud nos. Sed quia nos non habemus agere eas, ideo dispositio in eis apud nos est contraria dispositioni in rebus artificialibus.

confusa. Secundum aliam translationem et secundum Commentatorem *sunt composita* causata ex elementis. Per *confusa* etiam possunt intelligi universalia, scilicet cause universales que confuse et indistincte continent multas speciales et tunc per elementa intelligi possunt cause speciales et propinque.

Lt

alia translatio *mixta*

Ha

elementa et principia scilicet quia oportet procedere in hac doctrina ab istis que sunt nociora apud nos ad ista que sunt minus nota nature

Lt

Other glosses:

Innatum est nobis ut procedamus cognoscendo ab hiis que sunt nobis magis nota in ea que sunt magis nota nature, sed ea que sunt nobis magis nota sunt confusa qualia sunt universalia. Ergo oportet nos ex universalibus ad singularia procedere.

Lv (manus secunda). Cf. Thomas Aquinas, *In Physicam*, I, lect. 1, ed. cit., p. 4, no. 6.

id est confusa in specialia vel conposita in suas partes

Lv

Cap. 3: De modo ordinis doctrinae

IV. *Translatio vetus*: Unde ex universalibus in singularia oportet provenire; totum enim secundum sensum notius est, universale autem totum quiddam est; multa enim comprehendit ut partes universale.

provenire] pervenire LvHa; quiddam] quoddam LvHa

Translatio Scoti: Et ideo oportet procedere de rebus notis universalibus ad particulares. Universum enim notius est in sensu et universale est aliquod universum. Universale enim continet res plures tamquam partes.

[7F]

18 Cum declaravit quod causa propter quam debemus ire in hac scientia de posterioribus ad priora est quia semper debemus ire de illo quod est notum apud nos ad illud quod est ignotum apud nos, narravit quod propter hanc causam, scilicet ire de notiori apud nos ad latentius, oportet incipere in ordine doctrinae a cognitione causarum universalium et accidentium universalium, et dicit: *Et ideo oportet procedere* etc., id est et causa propter quam fuit necesse ut demonstrationes huius scientiae fuerint signa et est ire de notiori apud nos ad latentius, oportet etiam [7G] nos procedere in doctrina de rebus universalibus ad particulares.

19 Et intendit per universalia universalissima substrata, quae possunt inveniri in istis rebus

Unde ex universalibus: Commentator: Et intendit per universalia universaliter

rerum naturalium, scilicet de causis et accidentibus, quoniam, quanto magis universale fuerit communius, tanto magis continebit. Et ex hoc sermone declaratur quod intentio istius libri est loqui de rebus universalibus communibus omnibus quae constituuntur per naturam. Et cum dicit particularia, non intendit individua sed ultima<s> species, aut illa quae sunt quasi ultimae species. universalibus communibus omnibus] alia lectio: universalibus omnium	omnia que possunt inveniri in istis rebus rerum universalium scilicet de causis et accionibus, quia quanto magis universale fuerit commune, tanto magis comprehendit sive continebit. Et ex hoc sermone declarabitur quod intentio istius libri est loqui de universalibus rebus et communibus omnibus que constituuntur per naturam. Et cum dixit particularia, non intendit individua sed ultimas species aut illa que sunt quasi ultime species. Lv(→21)
20 Et cum declaravit modum ordinationis doctrinae in hac scientia et est quod [7H] oportet procedere de illo quod est magis commune ad illud quod est magis proprium, quia illud quod est magis commune est notius, quemadmodum via demonstrationis in hac scientia per hanc causam necesse fuit ire de posterioribus ad priora, incoepit dare causam propter quam fuit necesse ut universale intelligibile sit notius particulari quod est sub illo, et dixit: *universum enim* etc.,id est, res universales sunt notiores apud intellectum quam particulares, scilicet species, quia universale assimilatur individuo composito, et compositum est notius apud [7I] sensum, id est quemadmodum istud universum est notius apud sensum quod est quasi principium fidei, quam simplicia quae sunt causae illius universi, sci-	id est, universalia que plura (*v.l.* philosophi) confundunt in unam naturam, que sunt notiora apud intellectum quam specialia, ut dicit Commentator ibi: *Unde ex universalibus* vel sic: *confusa*, id est, composita proprie, ut individua que sunt nociora apud sensum quam principia que sunt cause illorum, ut ibidem dicit Commentator, quia magis confusa sunt nobis magis nota. LvHa. ut individua] Ha om.; illorum] eorum Ha; quia...nota] Lv om. alia translatio *mixta* scilicet composita proprie Lv

licet demonstrati, similiter universalia sunt notiora apud intellectum quam particularia.

21 Universale enim est aliquod universum, cum contineat multa. Quia igitur ita se habet ad intellectum sicut compositum particulare ad sensum, ideo dispositio universalis apud intellectum est dispositio particularis apud sensum. Causa igitur in hoc quod viae demonstrationum in hac scientia sunt de compositis ad simplicia, et in hoc quod princi[7K]pium doctrinae est de rebus universalibus, est quoniam universum demonstratum est notius apud sensum quam partes eius et universale est notius apud intellectum quam proprium.

et paulo post: est aliquod universum.

Lv(→24)

22 Et cum declaravit quod universale assimilatur universo composito demonstrato, dedit modum similitudinis et dixit: *universum enim continet* multas *res,* sicut *partes*, id est, universale enim continet multas species quae sunt sub eo, sicut partes rerum compositarum individualium.

Other glosses:

Dicitur quod tota diffinitio aggregata ex partibus est minus nota intellectui quam diffinitum. Quelibet tamen pars per se est nocior quia communior sive universalior. Aliter dicitur quod pars diffiniens dupliciter potest considerari: aut in quantum pars est et sic ignocior, aut in quantum est universum predicatum de diffinito et sic est noscior.

LvLk. Dicitur quod] Nota quod Lk; ex partibus] ex suis partibus Lk; communior sive] Lk om.; Aliter dicitur quod] vel sic Lk; diffiniens] diffinitionis Lk; dupliciter] Lk om.; aut] Lk om.; pars est] pars Lk; aut] vel Lk; sic est noscior] sic nocior Lk.

id est, in ultimas species. Loquitur enim hic de singulibus in via essencie cuiusmodi sunt illa quae non possunt dividi ulterius per formas ita dixi *sunt autem nobis* etc.

Lv

scilicet ita se habens ad intellectum sicut individuum ad sensum et ita universale est notius apud intellectum quam particulare quod est eius pars.

LvHa. ita[2]] ideo Ha; notius] magis notum Ha; quod est eius pars] Ha om. This is in Adam of Buckfield's commentary, Wellcome MS, fol. 2r.

Et hoc dicit quia species sunt potestate in genere et ita ut partes. Individuum autem quod vere est totum ita continet suas partes in actu ad minus sicut totum integrale ad suas partes, et huic consonat Commentator statim ibi *quodammodo*

Lv Ha. totum] Lv om.; partes suas Ha; ad minus...suas partes] Lv om.; ibi] post ibi Ha. This is in Adam of Buckfield's commentary, Wellcome MS, fol. 2r.

V. *Translatio vetus*: Sustinent autem idem hoc quodammodo et nomina ad rationem; totum enim quiddam et indiffinitum significat, ut circulus, diffinitio autem ipsius dividit in singularia. Et pueri primum appellant omnes viros patres et matres feminas, posterius autem determinant horum unumquodque.

Translatio Scoti: Et iam accidit hoc idem quoquomodo omnibus apud definitiones. Significant enim aliquod universum non determinatum. Verbi gratia, hoc nomen "circulus", definitio eius distinguitur per particularia. Et puer existimat in principio omnem virum quem vidit esse patrem eius, et omnem mulierem esse matrem eius. Deinde in postremo distinguit et determinat utrumque.

23 Cum declaravit causam propter quam universale est notius particulari quod est sub eo, incoepit docere quod propter hanc causam illud quod significat nomen est notius apud nos quam illud quod significat definitio apud intellectum, et dicit: *Et accidit*

similiter hoc idem etc., id est, et propter hanc causam accidit similiter eis que significant nomina apud illa quae significant defini[8A]tiones, scilicet quoniam illa quae significant nomina sunt notiora eis quae significant definitiones. Deinde dixit: *significat enim aliquod universum* etc., id est, et causa in hoc quod illa quae significant nomina sunt notiora definitionibus est quoniam nomen est aliquod universum et est species nominata, et illud universum non est distinctum, ut hoc nomen "circulus" quod significat universum indistinctum. Definitio vero eius, quae est figura plana intra quam est punctus a qua omnes lineae exeuntes ad circumferentiam sunt aequales, est universum distinctum et determinatum per elementa ex quibus constituitur circulus, scilicet genus et [8B] differentia. Et hoc intendebat cum dixit *distinguitur per particularia.* Vocat enim elementa species et particularia causas individui universi.

hec, scilicet quod ea que significant nomina diffinita sunt notiora apud intellectum nostrum quam ea que significat diffinitiones.

HaLt. ea que significat diffinitiones] ipse diffinitiones Lt.

Circulus. Diffinitio circuli est: *Circulus* est figura plana una linea contenta que circumferentia vocatur, in cuius medio est punctus a quo omnes linee exeuntes ad circumferentiam sunt equales.[22]

LvHaLk. *Circulus*...figura] scilicet que est circulus est figura Lk.; *Circulus*...medio] *diffinitio* que est hec figura circularis intra quam Ha.; vocatur] nominatur Lk

id est distinguitur per partes quibus constituitur species diffinita.

Ha

24 Et dicit *quoquomodo* quoniam illa quae significant, scilicet nomina specierum, assimilantur universali inquantum continet causas ex quibus constituitur species. Et differunt

quodammodo:alia translatio: *et quoquomodo*. Commentator: Et dixit quoquomodo quoniam illa que significant nomina, scilicet nomina specierum, assimilantur uni-ab eo in eo quod universale continet species. Universale ergo est aliquod universum specierum, et illud quod significant nomina est aliquod universum, divisumautem in causas ex quibus constituitur species. Universum vero in rei veritate est individuum compositum demonstratum, [8C] et similiter partes in rei veritate quae sunt partes individui.

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[22] Euclid, *Elements*, I, def. xv, Adelard II Version.

25 Et sunt illae de quibus dixit quod sunt notiores in sensu quam causae. Et ex hoc quod istud universum est notius apud sensum causis est causa in hoc quod universalia intellecta sunt notiora apud intellectum quam suae partes intellectae, sive illae partes sint species aut causae. Et similiter est causa in hoc quod res posteriores in esse sunt notiores apud nos quam causae.

26 Et quaeret aliquis quod hoc quod dixit quod *illa quae sunt primo evidentiora apud nos* etc., et hoc quod dixit post, *et accidit hoc idem in nominibus* [8D]*apud definitiones,* non sunt idem, quoniam impossibile est ipsum intelligere per res mistas compositas individua demonstrata cum ex istis non procedatur ad elementa et principia intellecta. Non enim sunt partes syllogismi, sed proceditur ad illud ex specie composita, non ex individuo. Ergo ista est

versali in quantum continet causas ex quibus constituitur species. Et differunt ab eo in hoc quod universale continet species. Universale igitur est aliquod universum specierum. Illud autem quod significat est aliquod universum divisum in causas ex quibus constituitur species. Universum autem in rei veritate est individuum compositum demonstratum, et similiter partes in veritate sunt que sunt partes individui.

Lv

dispositio speciei apud suas causas et dispositio eius quod significant nomina apud illud quod significant definitiones. Quomodo (?) igitur posuit hic alium modum?

syllogismi] alia lectio: similes

27 Ad hoc autem dicamus quod in primo sermone fecit comparationem inter species et suas [9E] causas secundum finem, et dixit quod species compositae apud nos sunt notiores suis causis, et quod ex istis speciebus procedimus ad cognitionem causarum mediantibus accidentibus existentibus in eis. In hoc autem sermone fecit comparationem inter species et causas suas secundum imaginationem, et dixit quod illud quod significant nomina sunt notiora apud nos quam illud quod significant definitiones.

28 Sunt igitur tres modi compositionis—scilicet compositio speciei ex suis causis et compositio generis ex speciebus—et utraque istarum compositionum est notior apud intellectum quam suae partes. Tertia autem compositio est comp[8F]ositio individui ex suis partibus, scilicet quae sunt secundum sui qualitatem, et ista compositio est notior apud sensum quam suae partes.

qualitatem] alia lectio: quantitatem

circulus. Commentator dicit quod tres sunt modi compositionis—scilicet compositio speciei ex suis causis et compositio generis ex suis speciebus—et utraque istarum compositionum est noscior apud intellectum quam partes. Tertia autem compositio est compositio individui ex suis partibus et que sunt secundum quantitatem, et ista compositio est noscior apud sensum quam sint partes.

LvHa. *circulus*...dicit] Et dicit Commentator Ha; species] causati Ha; compositionum] Ha om.; noscior] notior Ha; partibus et] partibus Ha; noscior] notior Ha.

Secundum Commentator triplex est compositio. Una generis ex suis speciebus, alia speciei ex suis principiis et utraque istarum est notior intellectui quam sue partes. Tertia individui ex suis partibus, et hoc modo compositum est notius secundum sensum quam sue partes. Unde semper compositum est nobis notius quam sue partes quod manifestum est.

Lk

29 Et eo quod ista compositio est notior apud sensum, ideo illi duo modi compositionis sunt notiores apud intellectum. Et ideo non est remotum ipsum intelligere per hoc quod dicit *et illa quae sunt apud nos manifesta sunt mista composita* secundum duos modos compositionis, scilicet compositionem individui et compositionem speciei. Individuum enim compositum, licet non sit principium in doctrina demonstrativa, [8G] tamen est principium acquisitionis universalis, quod est principium demonstrativae.

universalis] alia lectio: illius

30 Et cum declaravit quod commune est notius apud nos quam proprium quemadmodum compositum est notius simplicibus suis, dedit testimonium super hoc et dixit: *Et puer existimat* etc., id est, signum eius quod commune est notius apud nos quam proprium est quia videmus comprehensionem communem

praecedere propriam comprehensionem. Infans enim in principio comprehensionis existimat omnem virum esse patrem et omnem mulierem esse matrem, et cum vigoratur intellectus suus, cognoscit pa[8H]trem inter caeteros viros et matrem inter caeteras mulieres.

31 Iste igitur est prologus libri et continet intentionem et ordinem eius et modum doctrinae demonstrativae.

Other glosses:

Quodammodo potest dicere quia diffinitum secundum quod comparatur ad diffinientia ut totum ad partes ex quibus constituitur, sic est ipsum diffinitum nocius quam diffiniencia apud nos. Alio modo potest diffinitum comparari ad quamlibet partem diffinitionis, ut ad totum universale, et sic non est diffinitum nocius quam diffinientia, set econtrario.

HaLt. Quodammodo modo Ha; apud nos quam diffiniencia Ha; set econtrario] Lt om.

id est, proprium patrem et propriam matrem ab aliis, quod non contingit ei nisi comprehensio universalis precede[n]t comprehensionem particularem.

Lv

Scilicet quod sustinet universale ad suas species—videlicet quod sunt nociora intellectui quam diffinitio vel partes in diffinitione.

Lv(→22 gloss)

secundum Commentatorem singulare dicitur tripliciter, scilicet individuum vel species athoma et sic sumitur hic, vel causa et elementum speciei, et sic sumitur ibi *diffinitio autem ipsius dividitur in singularia.*

Lk

<*feminas*>, et ita distinguunt inter virum et feminam. <*determinatur*>, id est, discernunt inter patrem et ceteros viros et inter matrem et ceteras feminas, et sic aprehensio communis precedit tempore aprehensionem

specialem in nobis, quare signum est quod commune sit magis notum nobis quam speciale.

Ha

The *conclusiones* to the first *summa* in Ha are:
Primum: in adquirendo cognitionem rerum naturalium quod investiganda est cognitio causarum principiorum et elementorum rerum naturalium.
Secundum: in adquirendo cognitionem causarum principiorum et elementorum rerum naturalium, procedendum est a magis universalibus ad minus universalia.

In Lt fuller *conclusiones* are given:
Quod in omni scientia cuius sunt principia cause et elementa contingit scire ex cognitione principiorum causarum et elementorum ibi *quoniam quidem scire* etc.
Quod in naturali scientia a causis incipiendum est, ibi *manifestum est et de naturali scientia.*
Quod in naturali philosophia procedendum est a causis universalibus ad causas speciales ibi *Innata est nobis* etc.
Principalis conclusio: quod universale est nocius apud intellectum quam partes eius, ibi *sunt autem nobis primum* etc. vel quod cause speciales sunt nature nociores.
Quod universale quoddam totum est ibi *universale autem quoddam totum est.*

The Oxford gloss tends to choose the sentences from Averroes which explain the meaning of individual words or phrases; hence especially sentences beginning "et intendit [Aristoteles] per…." The more general philosophical discussions in Averroes are omitted. What is more striking is that the whole of Averroes' discussion of the kinds of demonstration is left out, and there is no indication in any of the British Library manuscripts of the glossator's awareness of Averroes' Proemium, where he would have found more discussion of the *via doctrinae*. Of course, a marginal gloss is not where one might expect to find longer expositions of doctrine, and the main aim of the Oxford gloss in particular appears to be word-for-word explication of the text. There is, however, in the lower left-hand margin of MS Lt the equivalent of a proemium, but of a jejune kind which hardly matches the philosophical acumen of Averroes' text.[23] It is the latter text that interested a Neapolitan scholar at the beginning of the sixteenth century and to which we now turn.

II

In the academic year 1507, students of natural philosophy at the University of Naples asked for a special explanation of Averroes' Proemium to the *Physics*. Their teacher, Pietro d'Afeltro, went beyond the call of classroom duty by publishing a full commentary on what he called a "very difficult and obscure" text. In the two decades since he first taught philosophy, d'Afeltro had published but once. Evidently he felt that now was the time to present such an exposition to the wider world of natural philosophy.[24]

His *Prohemii Averroys in libros phisicorum Aristotelis expositio* is a booklet printed without indication of date or place and known in only two copies, one in the British Library (IB. 21097), the other in the Biblioteca Casanatense in Rome.[25] Ada Moricca-Caputo, describing the Casanatensan copy, came to the conclusion that the booklet was printed either between 1509–11 or 1516–21, on the grounds that it is dedicated to Bernardino Carvajal whilst he was a Cardinal of the "Sede suburbicaria" of Sabina during these two periods.[26] Dennis Rhodes, in a more detailed article based on the British Library copy,[27] argues that, since Carvajal had already received the title of "Cardinal of the Holy Cross and legate of the Apostolic See" (this is the title he holds in the dedication) in 1495, the work could have been dedicated to him at any time after that date, but that the printer appears to be Ioannes Antonius de Caneto who did not start printing in Naples until 1504. The booklet is, therefore, catalogued in the British Library as "Naples, circa 1505." Since then, however, it has been dated by C. Bianca between July 16 and August 3, 1507, the period during which Carvajal held the title Cardinalizio.[28]

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[23] The preliminary remarks in Lt begin and end as follows: "In scientia naturali est consideratio de corpore mobili sicut de subiecto. Unde sicut distinguibilis est consideratio de corpore mobili, secundum hoc distinguitur scientia naturalis per partes suas et libros suos...aut secundum proprietates et passiones que accidunt ei ex parte anime et secundum hoc est perscrutatio in libro De anima et in ceteris parvis libris." Silvia Donati has pointed to the similarity of these remarks to the introduction to the anonymous *Quaestiones super Physicam I-VIII* in Siena, Biblioteca Comunale degli Intronati, L.III.21, fol. 2rb and Cambridge, Gonville and Caius, 509, fol. 1vb (personal communication, and see also Donati, "Studio dei commenti," (as note 19), 396-409).

[24] This paragraph is based on d'Afeltro's preface, reprinted on 86-7 below, and on C. Bianca, "D'Afeltro, Pietro," in: *Dizionario Biografico degli Italiani* 31, Rome 1985, s.v.

[25] The *Expositio* is referred to in Schmitt, "Renaissance Averroism" (as note 3), 130, 139, and 141, as an important text which "apparently [has] not been given serious consideration" (130).

[26] A. Moricca-Caputo, "Appunti su alcuni incunaboli casanatensi," in: *Studi di bibliografia e di argomento romano in memoria di Luigi de Gregori*, Rome 1949, 310. A photograph of a page of the Casanatensan copy is included in *Indice*

Born in 1463, d'Afeltro was appointed by King Ferdinand of Aragon to teach metaphysics at the University of Naples at the age of twenty-four. This teaching post was cut short by the closing of the university during baronial wars, though circumstances did not prevent d'Afeltro from publishing a *Questio de subiecto naturalis philosophie* at the end of the 1480s, in which he sides against Thomist and Scotist doctrines then current in the intellectual life of the city. In 1507–8, soon after the reopening of the university, d'Afeltro was back teaching physics with a stipend of 50 ducats. He went on to instruct in "Filosofia de fisica" and "Filosofia de anima" and, after 1518, in medicine. He last appears in the records of the university in 1523–4.

In 1508 d'Afeltro dedicated a book entitled *De fato* to Cardinal Oliviero Carafa. In 1526 his *Lectio prima in Methaphysica et Questiones in duodecim libris Methaphysice* was printed in Naples and was accompanied by eulogistic poems by several Neapolitan writers, among them Geronimo Carbone and Pietro Summonte. Rhodes considers that this indicates that "Petrus Feltrus was acquainted with members of the Neapolitan Academy of Giovanni Pontano (1426–1503)", and indeed, according to Bianca, as early as 1483 d'Afeltro is mentioned in an epigram addressed by Pontano to Carbone. The dedicatee of the exposition of Averroes' Proemium is Bernardino Lopez de Carvajal (1455–1523), who visited Naples several times as Cardinal of Santa Croce

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Generale degli Incunaboli Biblioteche d'Italia, no. 3811; here the printing is wrongly given as Mathias Moravus at Naples in 1480 or 1481.

[27] D. E. Rhodes, "A Note on Petrus Feltrus," in: *Beiträge zur Inkunabelkunde*, 3rd series 1 (1965), 111-2.

[28] C. Bianca, "D'Afeltro, Pietro" (as note 24). Biographical information in the following paragraphs is drawn from Bianca and from Rhodes.

in Gerusalemme (in Rome) and acted for a time as Governor of the Campagna.

Since Rhodes has given a full codicological description of the booklet, it suffices to mention here the crude state of the printing, the numerous errors, and the almost complete lack of punctuation in the text. The text of Averroes that Pietro uses is basically that of Theodore of Antioch, as it appears in the editions of Aristotle with the commentaries of Averroes printed in Venice by Bernardino de Tridino de Monteferato (= Bernardinus Stagninus) in 1489,[29] and the edition of Agostino Nifo printed in Venice by Octavianus Scotus in 1495.[30]

Of the eight headings among which Averroes divides his Proemium,[31] that on the *via doctrinae* receives by far the fullest treatment in d'Afeltro's exposition. In fact, whereas Averroes devotes barely one sixteenth of his Proemium to the *via doctrinae*, Pietro d'Afeltro expands this topic to over a quarter of the whole text. He crams his argument with quotations from both philosophical and medical writers in an analysis of what Averroes really meant by his different kinds of "demonstration".

We have extracted this debate on method from d'Afeltro's text and edited it below. The edition of this extract is preceded by that of d'Afeltro's preface and the opening sentences of the exposition. We have attempted to correct the printer's errors and have introduced punctuation and paragraphing to make the flow of the argument easier to follow. < > indicate an editorial addition; [ ] an editorial subtraction. The Italianate orthography of the Latin ("e" for "ae", "demostra-" for "demonstra", "coment-" for "comment-", etc.) has been retained. We have occasionally linked technical terms (e.g., "propter-quid") to distinguish them from the surrounding syntax. We have marked each change of authority with a number. When describing the opinion of a particular authority d'Afeltro tends to use "ipse/iste" for that authority and "is/ille" for Averroes or another scholar referred to by that authority. D'Afeltro's method is to go through the interpretations of other scholars (**I**.1–10) and then to give his own interpretation of the "mind of the Commentator" and the definition of the three kinds of demonstration (**II.A–C**), the third of which is further described according to the three epithets attached to it (**C**.i–iv). After this he adds several further points (**III–V**), introduced by "ulterius..."

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[29] We have used the very elegant British Library copy, IC.22131.

[30] British Library, IB.21097. We have also consulted the Venice Giunta 1550 edition.

[31] The number of headings that should be discussed in a proemium is the topic of Paulus Israelita's *De prooemio et eius partibus questio* which precedes Averroes' Proemium in a collection of texts by Paulus Israelita printed in Milan in 1511 (British Library copy 715.i.1). Paulus' work is not a commentary on Averroes' Proemium as such.

Reverendissimo domino domino Belardino Carvagiali Cardinali Sancte Crucis[a] ac Sedis Apostolice Legato, Petrus Feltrus de Neapoli medicorum ac philosophorum minimus foelicitatem perpetuam.

<C> Um hoc anno ordinariam philosophiae Aristotelis—scilicet libros ascultatorios—in gimnasio Neapolitano publice legerem, divinarum humanarumque rerum interpres sapientissime, plerique qui, ut audientium moris est, mihi etsi indignissimo afficiebantur, me rogarunt ut Averroys ad eosdem libros prohemium pregnans valde difficile atque obscurum enodarem, itaque aperirem ut facile omnes capere id possent, cupiens eorum honeste[b] petitioni quoad possem satisfacere, honus istud etsi viribus meis longe impar subire non recusavi.[c] Et quoniam, ut Aristoteles .ix. sue Monastice[d] testatur, non aliter preceptori quam deo ac parentibus debemus, persuasissimum mihi visum est tibi, preceptori ac domino meo observandissimo, omnem hanc nostram elucubrationem dicasse. Nam benignum est ut semper arbitratus sum ac plenum ingenui pudoris fateri quemquam per quem profecerit. Quis preterea est qui ignoret quantum semper nostris bonis artibus quantumque studiosis hominibus et faveris et faves, quantumque gaudii capias cum aliquid speculatione dignum tibi defertur? Quare nihil profecto, mihi crede, tam difficile in vita hactenus passus sum quam tuis tantorum doctissimorumque virorum conventibus interesse tamdiu non potuisse, in quibus tua disserendi subtilitate[e] tuoque dicendi lepore omnes bonarum disciplinarum quot aderant professores meque ipsum pre ceteris in admirationem vertebas non parvam. Accipe igitur tua qua soles innata humanitate has nostras qualescumque vigilias, philosophie, theologie ac theorie omnis decus ac gloria, quas si a tua tantum intellexerimus probatas esse sublimitate, ab aliis quos ita invidia sicut rubigo ferrum consumit, inimice aut legi aut contempni equo animo paciemur. Vale et in hac luce felix semper vivas meque servum ac discipulum tuum cordatissimum ut soles ama.

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[a] A sign of the cross is printed instead of the word "Crucis".

[b] honoste pr. [c] recusani pr. [d] Ethics (reference not found).

[e] suctilitate

To the most reverend lord Lord Bernardino Carvajal, Cardinal of the Holy Cross and Legate of the Apostolic See, Pietro d'Afeltro, the least of doctors and philosophers, <wishes> perpetual happiness.

When in this year I was reading publicly in the Gymnasium of Naples the ordinary <lectures> on the philosophy of Aristotle—i.e., his books of *Physics*—O most wise interpreter of things divine and human!, there were many who through their attachment to me (most unworthy though I am), as is the custom of students, asked me to explain Averroes' Proemium to these books, being pregnant <with information, but> very difficult and obscure, and to reveal it in such a way that all should be able to understand it clearly. Desiring to satisfy their worthy request as far as I could, I did not refuse to undertake this task, although it is far beyond my capacities. Since, as Aristotle says in the ninth book of his *Ethics*, we owe the same to our teacher as to God and our parents, it seemed most compelling to me that I should have dedicated the whole of this clarification of the text to you, my teacher and most solicitous lord. For it is polite, as I have always thought, and the height of noble humility for someone to acknowledge the person through whom he has made progress. Moreover, who is there who does not know how much you have favoured and still favour our worthy Arts and those men who study them, and how much you rejoice when anything worthy of speculative thought is presented to you? So, believe me, I have suffered nothing at all so difficult in this life than not to have been able to participate in your gatherings of great and learned men, in which by your subtlety of conversation and elegance of diction you excited the admiration of all the professors of worthy disciplines who were present, and myself above all. Accept, therefore, with the inborn kindness which is customary to you, these results of our labours, such as they are, O crown and glory of all philosophy, theology and theoretical thought! If we only know that they are approved by your Highness, we will suffer with equanimity their being read and dismissed in a hostile fashion by those whom envy consumes as rust consumes iron. Goodbye! and in this world may you always live happily, and love me, your servant and disciple, with all your heart, as you usually do.

Aiir

Incipit Prohemii Averroys in libros Phisicorum Aristotelis expositio secundum Petrum Feltrum de Neapoli artium et medicinae doctorem in gimnasio Neapolitano[f] ordinariam philosophiae publice legentem.

<I> stud Averroys prohemium dividitur in duas partes. In prima premittit quae et quot in ipso determinare intendit. Secundo illa declarat secundum[g] ibi: "Dico ergo". In prima dicit "Intentio mea in hoc sermone est glosare librum Aristotelis qui dicitur Auditus Naturalis, et quia glosatores consueverunt dicere in principio libri octo capitula—scilicet Intentionem libri, Utilitatem, Ordinem, Divisionem, Proportionem, Viam doctrine, Nomen libri et Nomen Auctoris, dicam et ego" omnia ista "licet plura ex istis possint intelligi ex prohemio libri, sicut in sequentibus ostendemus". Possunt namque ex prohemio libri intelligi intentio libri, ordo, proportio, utilitas ac via docrinae ut ex dicendis patebit. Deinde cum dicit "dico ergo quod" declarat predicta octo quae premisit. Et partitur hec pars in octo partes secundum quod octo declarat quae premisit declaranda; partes patebunt legendo litteram. In prima dicit "quod intentio scientie naturalis in summa cuius" intentionis "iste liber est pars est cognoscere causas specierum sensibilium et causas" visibiles "in eis" speciebus "accidentium, quia subiectum istius artis non sunt nisi res sensibiles—subiectum, dico, secundum quod transmutantur de se, id est, secundum quod habet de se principium motus et quietis". Pro quorum verborum intellectu...

B iiiir

<I>...Quantum ad sextum—scilicet de "via doctrine huius libri"—dicit Comentator quod "sunt species doctrine usitate in hac scientia et sunt modi omnium disciplinarum"—scilicet tres modi demostrationum[32]—, "scilicet <demostratio> signi, demostratio cause et demostratio simpliciter, quamvis signum et causa sint[h] plus usitata in hac scientia, et

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[f] Neapolirano pr. [g] secunda pr. [h] sit pr., 1495 ed.; sint, 1550 ed.

Here begins the exposition of Averroes' Proemium to the books of the *Physics* of Aristotle, according to Pietro d'Afeltro of Naples, doctor in the Arts and Medicine, and public reader of the ordinary <lectures> of philosophy in the Gymnasium of Naples.

This proemium of Averroes is divided into two parts. In the first he lays out beforehand what topics and how many he intends to define in it. Secondly he explains them, where he says "I therefore say…" In the first part he says, "My intention in this writing is to comment on the book of Aristotle which is called 'Hearing about Nature', and because the commentators are accustomed to discussing eight topics at the beginning of a book—i.e., the intention of the book, its usefulness, order, division, relation, way of teaching, and the name of the book and the name of its author, I too shall discuss" all these "although most of them can be understood from the proemium of the book, as we shall show in what follows." For from the proemium of the book can be understood the intention of the book, its order, relation, usefulness and the way of teaching, as will be clear from what has to be said. Then, when he says "I therefore say that", he explains the eight topics which he has laid out beforehand. This second part, then, is divided into eight parts according to the eight topics which he has laid out beforehand to be explained. The <division into> parts will be clear from reading the text. In the first part he says "that the intention of natural science (of which" intention "this book is part) in sum is to understand the causes of sensible species and the" visible "causes of the accidents that occur in those" species, "because the subject of this art is none other than sensible things—the subject, I say, according to the fact that they change in themselves, i.e., according to the fact that they have the principle of movement and rest in themselves". To understand these words…

I As for the sixth [topic]—i.e., "the way of teaching in this book", the Commentator says that "they are the species of teaching used in this science. And they are the kinds belonging to all disciplines"—i.e., the three kinds of demonstrations,[32] "i.e., <demonstration> of the sign, demonstration of the cause and demonstration *simpliciter*, although sign

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[32] This gloss (if it is such)—scilicet tres modi demonstrationum—appears in the 1489 and 1495 editions of Aristotle-Averroes, but not in the 1550 and 1562 editions; it has a correspondence in Mantino's translation: "trium generum demonstrationum."

aliquando est usitata demostratio simpliciter." Sed quid per hos tres modos demostrationis Comentator intellexerit dissonant moderni et varia ac aliena ab eius mente sentiunt. <1> Nam Gaetanus[33] quandoque dicit eum per demostrationem simpliciter intellexisse demostrationem in suo esse potissimo, et est, dicit ipse, cuius medium aggregat omnia genera causarum; aliquando dicit eum intellexisse demostrationem dantem causam et esse. <2> Burleus[34] autem .ii. huius tractatu et cap. secundis (?) exponens Comentatorem comento .xxii. ubi loquens contra Avicennam, ponit etiam hos tres modos demostrationis,[35] dicit Comentatorem intellexisse illam que est in suo esse potissimo et est, dicit ipse, cuius medium aggregat omnia genera causarum vel causam potissimam, demostratio simpliciter dicta. Per demostrationem autem propter-quid[36] dicit Comentatorem intellexisse illam que est per causam

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[33] Gaetano da Thiene (1387-1465), *Recollectae super octo libros Physicorum Aristotelis*, Venice, 1496, fol. 2r (prologus): "Sexto manifestat commentator vias huius doctrine et dicit quod sunt tres modi demonstrationis qui usitantur in doctrinis, scilicet demonstratio signi, demonstratio cause, et demonstratio simpliciter. Et per demonstrationem signi intelligit illam que est ab effectu ad causam. Effectus enim significat suam causam, similitudinem eius quodammodo gerendo. Per demonstrationem cause intelligit illam que est a causa ad effectum suum, dummodo non sit potissima. Per demonstrationem autem simpliciter intelligit demonstrationem potissimam, cuius medium aggregat omnia genera causarum illius quod demonstratur." Ibid., fol. 3r (comm. to *textus* 1): "Per demonstrationem vero simpliciter intelligit commentator demonstrationem cause et esse."

The first of these two definitions ("cuius medium aggregat omnia genera causarum") comes up several times in d'Afeltro's *Expositio*, but without an obvious source in Averroes. Among the commentaries cited here, the earliest such instance is in that by Walter Burley (see following note).

[34] Walter Burley (1275-1345?), *Expositio in octo volumina Aristotelis de Physico auditu*, Venice 1482, fol. 46r: "Sed hic potest dubitari quid scilicet commentator intelligat per demonstrationem simpliciter et quid per demonstrationem propter quid et qualiter ille demonstrationes differunt. Et videtur mihi quod per demonstrationem simpliciter intelligat demonstrationem in suo esse potissimo. Et est illa demonstratio cuius medium dicit quid vel propter quid, vel cuius medium aggregat omnes causas vel saltem causam potissimam. Demonstratio autem propter quid est illa que est per causam propinquam in quocumque genere cause fuerit, quoniam per omnem causam contingit demonstrare propter quid."

Burley's most noteworthy discussion of the three kinds of demonstration is here, in his comment on *Physics* ii, rather than on the first chapter of the first book, otherwise known as the methodological prologue to the whole work. On the evidence of d'Afeltro's text and citations, there were four classic allusions to the three kinds of demonstration in Averroes' Large Commentary on the *Physics*: Proemium; bk. i, comm. 2; bk. ii, comm. 22; and bk. viii, comm. 58.

and cause are more used in this science; and sometimes demonstration *simpliciter* is used." But as to what the Commentator understood by these three kinds of demonstration, modern <scholars> disagree and have opinions which differ from each other and are foreign to the mind of the Commentator. (**1**) For Gaetano[33] sometimes says that he understood by "demonstration *simpliciter*" demonstration in its most powerful existence, and it is, Gaetano says, that whose middle term combines all the kinds of causes; <but> at <other> times he says that he understood <by it> demonstration giving cause and existence. (**2**) But Burley,[34] in the second tractate of this <book> and the following chapters (?), explaining the Commentator in his 22nd comment (where, speaking against Avicenna he also posits these three kinds of demonstration[35]), says that the Commentator understood that <demonstration> which is in its most powerful existence, and, Burley says, that whose middle term combines all the kinds of causes or "the most powerful cause", is called demonstration *simpliciter*. By "demonstration *propter-quid*"[36] he says that the Commentator understood that which is (occurs) through a

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[35] Giunta edition, vol. IV, fols 56M-57A: Avicenna holds with Aristotle that no science can demonstrate the causes of its own subject. Averroes counters: "Et cum hoc audivit, existimavit hoc esse impossibile in tribus modis demonstrationum, scilicet in demonstratione simpliciter, & demonstratione quia, & demonstratione propter quid. Et non est ita. Hoc enim non est impossibile, nisi in demonstratione simpliciter, & demonstratione propter quid. In demonstratione autem quia, non est impossibile." Aristotle's own demonstration, he continues, of the existence of the first mover in the *Physics* is a demonstration *quia* or "per signum." For an introduction to the wider meaning of this disagreement, see John F. Wippel, "Essence and Existence," in: Norman Kretzmann et al. (eds.), *The Cambridge History of Later Medieval Philosophy* , Cambridge 1982, 386-7.

[36] D'Afeltro uses the term adopted by Mantino in this context rather than Theodore's "demonstratio causae." It should be noted, however, that the term "demonstratio propter quid" (and "quia") does occur in the old translation of Averroes, though not in the Proemium: in fact it occurs precisely in the passage in question: bk. ii, comm. 22 (Giunta edition, vol. IV, fol. 57A).

propinquam in quolibet genere cause. <3> Et hanc viam sequtus est archiepiscopus Amalfitanus[37] in questionibus suis primo Analeticorum Posteriorum, questione .xxi. <4> Alii nullam volunt fieri differentiam inter demostrationem simpliciter et propter-quid, quoniam si demostratio simpliciter, ut aiunt, esset aliud genus demostrationis a propter-quid, tunc esset aliquod genus demostrationis[i] nondum ab Aristotele inventum. <5> Cuius opinionis fuit magister Paulus Heremita[38] in commento suo primo Posteriorum ad obiecta contra diffinitiones /Biiii^{v}/ demostrationis, ubi ponit solutionem quorumdam dicentium demostrationem qua demostratur habere tres de triangulo per habere angulum extrinsecum (?) nec esse quia nec propter quid sed simpliciter. <6> Et est positio Iacobi de Forlivio[40] primo Microteghni questione prima ubi tenet quod si de ratione formali demostrationis propter-quid sit procedere per causam propriam[41] et immediatam, non est sufficiens divisio demostrationis qua dividitur in

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[i] demostretionis pr.

[37] Possibly Antonius de Carlenis, O.P., "archbishop" of Amalfi, 1449-60; however, only a commentary on the *Metaphysics* is mentioned by C. H. Lohr, *Commentateurs d'Aristote au Moyen-Age Latin*, Fribourg-Paris 1988.

[38] Paul of Venice (d. 1429), *Expositio in libros posteriorum Aristotelis*, Venice, 1477; repr. 1976, One relevant passage occurs in Paul's commentary on bk. i, ch. 24. After laying out the arguments presented and then refuted by Aristotle for the superiority of particular demonstrations over universal ones, Paul considers whether any of these supposed particular demonstrations is a demonstration at all (fol. m7v): "Dubitatur circa dicta probando nullam esse demonstrationem particularem. Et primo sic omnis demonstratio est per causam vel per effectum, sed silogismus probans habere tres angulos de ysochele per triangulum nec est per causam nec per effectum. Ergo talis silogismus non est demonstratio maior patet ex determinatis in hoc libro . . .

Ad primum respondet dupliciter Egidius <Romanus>. Et primo quod illa non est sufficiens divisio omnis demonstratio est per causam vel per effectum, sed illa omnis demonstratio est per causam vel per habens causam aut per effectum. Modo licet demonstratio qua concluditur habere tres de ysochele per triangulum non sit per causam nec per effectum. Est tamen per habens causam, quoniam triangulus habet causam illius passionis habere tres que est passio immediate precedens scilicet habere angulum extrinsecum equivalentem duobus oppositis intrinsecis trianguli.

Secundo respondet Egidius quod illa demonstratio est per causam non quidem propinquam sed remotam eo quod triangulus non est causa immediata illius passionis habere tres angulos sed remota quia mediat alia causa scilicet habere angulum extrinsecum equivalentem duobus oppositis instrinsecis. Et cum dicitur causa remota demonstrat affirmati<v>e sed negative verum est de causa remota non convertibili sed convertibili bene demonstratur affirmative.

Contra predicta arguitur et primo quod illa divisio est sufficiens. Nam omnis demonstratio facit scire ergo simpliciter vel secundum quid, patet tam

proximate cause in <the case of> any kind of cause you like. (**3**) And the Archbishop of Amalfi[37] followed this way (interpretation) in his questions on the first <book> of the Posterior Analytics, question 21. (**4**) Others do not wish any difference to be made between demonstration *simpliciter* and *propter-quid*, since if demonstration *simpliciter*, as they say, were a different kind of demonstration from *propter-quid*, then there would be a kind of demonstration not yet invented by Aristotle. (**5**) Paul the Hermit[38] was of this opinion in his commentary on the first book of the Posterior <Analytics> answering the objections against the definitions of demonstration, where he posits a solution for certain people[39] who say that the demonstration by which "having three" is demonstrated of a triangle through <its> "having an external angle" (?), is not <a demonstration> *quia* nor *propter-quid*, but *simpliciter.* (**6**) And this is the position of Jacopo da Forlí[40] in the <commentary to the> first book of the *Microtegni* <of Galen>, the first question, where he holds that if from the formal argument (*ratio*) of demonstration *propter-quid* it is <possible> to proceed through a proper[41] and immediate cause, the division of demonstration by which it is divided into *quia* and *propter-quid* is not sufficient, but it will

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consequentia quam antecedens ex determinatis si aliqua demonstratio facit scire simpliciter illa est per causam iuxta diffinitionem scire simpliciter datam in principio libri. Si autem facit scire secundum quid hoc est per effectum vel per causam remotam ut patuit in capitulo differentiarum demonstrationis quia et propter quid. Et ita omnis demonstrationis est per causam vel per effectum."

[39] See, for example, Gaetano da Thiene, *Recollectae*, bk. i, quest. 2, fol. 3r: "...ut si mihi nescienti triangulum habere tres angulos demonstraretur illud propter ipsum habere angulum extrinsecum equalentem duobus intrinsecis oppositis talis diceretur demonstratio simpliciter."

[40] Jacopo da Forlí (d. 1413), *Singularis expositio et quaestiones in artem medicinalem Galeni quae vulgo Techni appellatur quam emendatissime* Venice, 1547, fol. 84v: "Ad secundum conceditur aliquam esse demonstrationem in qua non proceditur ab effectu ad causam, nec econtra. Et sic concedendum est aliquam esse demonstrationem quae nec est quia, nec propter quid. Intelligendo per demonstrationem propter quid demonstrationem a causa ad effectum procedentem. Et econverso per demonstrationem quia. Intelligendo tamen per demonstrationem propter quid, omnem illam qua ex simpliciter notioribus procedimus ad ignotiora simpliciter. Geometrices demonstrationes sunt dicendae propter quid. Ex quo sequitur quod demonstratione sufficienter divisa in demonstrationem quia & propter quid non est formalis ratio demonstrationis propter quid: a causa ad effectum procedere, sed a simpliciter notioribus ad ignotiora simpliciter."

[41] Perhaps read "proximam", i.e., "proximate".

quia et propter-quid, sed bene erit sufficiens si ratio formalis demostrationis propter-quid sit procedere ex simpliciter notioribus. Omnis ergo demostratio, secundum Iacobum, vel est ex notioribus nobis non nature[42]—et sic est demostratio signi—, vel est ex simpliciter notioribus, et hoc dupliciter: vel ista sunt causa et sic est propter-quid, vel non sunt causa et sic est simpliciter. <7> Sed hanc positionem impugnat Paulus[43] ubi supra quoniam hoc dato daretur aliquod genus demostrationis nondum ab Aristotele inventum. Et idem repetit ipse eodem primo capite. Sed differt quia et propter-quid scire, respondendo ad secundum(?). Iste tamen, licet nullam fecerit differentiam inter demostrationem simpliciter et propter-quid,[44] fecit tamen differentiam inter demostrationem simpliciter et simplicem. Unde .ii. Posteriorum ad principium dicit Comentatorem per simplicem demostrationem intellexisse demostrationem concludentem propositionem de .ii. adiacente (?). <8> Sed, pace sua, dixerim: id non fuit de mente Comentatoris. Nam .vi. Methafisice com.i. inquit: "Dico autem demostrationem simplicem que reddit[j] causam et esse insimul". Et eodem commento paulo inferius dicit: "Eiusdem enim scientie est scire aliquid esse et quid sit, quod fit per simplicem demostrationem".[45] Idem ergo intellexit Comentator per demostrationem simplicem et simpliciter. <9> Ioannes autem de Ianduno Comentatoris cordatissimus, de quo .ii. De anima q. xvi. dicit quod fuit subtilissimus[k] philosophus et perfectissimus

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[j] redit pr. [k] suctilissimus pr.

[42] Note that d'Afeltro uses the datives "to us" (*nobis*) and "to nature" (*nature*), as in the Greek-Latin versions of the *Physics*, and not the preposition "apud" which is used in the *Translatio Scoti* and Averroes' Large Commentary and, on the evidence of the Epitome, stands for the Arabic "ᶜinda".

[43] Paulus Venetus, *Expositio in libros posteriorum Aristotelis*, bk. ii [fol. q3]: "De his enim tribus modis sciendi per demonstrationem facit commentator mentionem secundo phisicorum dicens triplicem esse demonstrationem, scilicet simplicem, quia est, et propter quid est. Intelligendo per demonstrationem simplicem demonstrationem concludentem propositionem de 2 adiacente." Note that the Averroes (*Physics* ii, comm. 22; Giunta edition, vol. IV, fol. 57A) reads "simpliciter" rather than "simplicem."

[44] Perhaps construe: "And he repeats the same in the first chapter: ' But to know *quia* and <to know> *propter-quid* are different.' In attending to the latter <kind of demonstration>, he, however, makes no difference between demonstration *simpliciter* and *propter-quid*."

[45] Giunta edition, vol. VIII, fol. 144K-L: "simplicem demonstrationem, quae reddit causam, & esse insimul. . . . Eiusdem enim scientiae est scire aliquid esse, & quid sit, quod sit per simplicem demonstrationem." This is an important passage for

be well sufficient if the formal argument (*ratio*) of demonstration *propter-quid* is <able> to proceed from what is more known *simpliciter.* Therefore, every demonstration, according to Jacob, either is from <things> more known to us and not to nature[42]—and thus is a demonstration of the sign—, or is from <things> more known *simpliciter*, and this in two ways: either these things are the cause and thus it is a *propter-quid* <demonstration>, or they are not the cause, and thus it is <demonstration> *simpliciter.* **(7)** But Paul,[43] in the place mentioned above, attacks this position, since, given this, a kind of demonstration not yet invented by Aristotle would be given. And he repeats the same in the same first chapter. But to know *quia* and <to know> *propter-quid* are different, by replying to the second (?). He, however, although he makes no difference between demonstration *simpliciter* and *propter-quid*,[44] nevertheless makes a difference between demonstration *simpliciter* and simple demonstration. Hence in the second <book> of the Posterior <Analytics> at the beginning, he says that the Commentator by simple demonstration meant a demonstration concluding a proposition from the second adjacent (?). **(8)** But, with all due respect to him, I would say: That was not in the mind of the Commentator. For, in the first comment to the sixth <book> of the Metaphysics, he says: "I call simple demonstration that which renders cause and existence at the same time." And a little further down in the same commentary he says: "It belongs to the same science (knowledge) to know that something is and what it is, which happens through simple demonstration".[45] Therefore the Commentator understood the same by simple demonstration and demonstration *simpliciter.* **(9)** Jean de Jandun, <who is> closest in heart to the Commentator—about whom in the second <book> of the De anima, question 16, he says that he was the most subtle philosopher and most perfect expositor and more excellent than them all (see also the third

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d'Afeltro's discussion of terminology, since it reads "simplicem" rather than the usual "simpliciter."

Zimara comments in his *Solutiones*, Giunta edition, vol. VIII, fol. 408v: "Tertia contradictio est in eodem primo commento. Dicitur quod eiusdem scientiae est scire quia est rei, & quid sit res illa. Huius tamen oppositum sequitur ex dictis Averro. 2 phy. com. 26, ubi habet quod scientia Naturalis bene cognoscit esse abstractorum, non autem cognoscit quiditatem. Solvitur. Dictum Philosophi habet locum hic, quando si est investigatum fuerit a priori: fallit autem, quando tale si est investigatum fuerit a posteriori: sicut procedit instantia ex 26 secundi phy. Et ista glosa est ipsius Aristote. 2 poster. & Aver. tex. com. 8, sicut clare videre poteris."

expositor et excellentior super omnes, et plus .iii. De anima q. xxxviii. tenet .xii. Methafisice q.iii.[46] quod Comentator forte intellexit per demostrationem simpliciter demostrationem que est per causas remotas sed per demostrationem propter-quid intellexit demostrationem que est per causam propinquam. Sed iste, licet corda/Bv^{r}/tissimus fuerit eius imitator, penitus doctrine Comentatoris oblitus gravius aliis erravit. Nam Comentator ubique voluit demostrationem simpliciter esse longe perfectiorem, cum det causam et esse simul. Quare absoluta dicta est demostratio atque potissima, ut statim declarabitur ipsa propter-quid-tantum demostratione. **<10>** Quidam etiam Comentatoris expositor monacus Urbanus Bononiensis[47] dictus .ii. huius comento .xxii. tenuit cum Ioanne quod Comentator per demostrationem simpliciter intellexit demostrationem quia que est per causam remotam, que potest dici demostratio simpliciter, id est, largo modo exponit. Sed hic non minus Ioanne erravit, ut statim patebit.

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[46] Jean de Jandun (d. 1328), *Questiones perspicacissimi peripatetici ... in duodecim libros Metaphysice*, Venice, 1525, fol. 129r: "Notandum ulterius propter solutionem rationum: sicut Commentator tangit 2. physic. et aliqualiter in isto 12. [margin: "Commen. 22."] quod tres sunt modi demonstrationum. Quedam est demonstratio simpliciter, quedam propter quid, et quedam quia. Sed Aristoteles tantum in libro poster. de duabus demonstrationibus dixit, scilicet de demonstratione propter quid et quia. Sed forte comprehendit demonstrationem simpliciter sub demonstratione propter quid. Unde Commentator forte intellexit per demonstrationem simpliciter demonstrationem que est per causas remotas, seu per demonstrationem propter quid, intelligit demonstrationem que est per causas propinquas. Sed per demonstrationem quia, intelligit demonstrationem que est per effectus posteriores et signa."
In the margin, the editor comments: "Graviter erravit doctor iste (salva pace eius dixerim) in via Commentatoris. ... demonstratio simpliciter non est demonstratio per causam remotam: imo est demonstratio potissima: de qua eleganter dixit Themistius in 2. poster. ca. 2." (See the quotation at note 57 below.)

[47] Urbanus Averroista (*Physics* commentary, 1334), *Commentorum omnium Averroys: super librum Aristotelis de physico auditu expositor clarissimus*, Venice, 1492, bk. ii, comm. 22, contains no statement exactly like this. D'Afeltro must have found this definition of demonstration *simpliciter* in Urbanus by reasoning in the following way:
First, Urbanus follows Averroes into a discussion of the "three kinds of demonstration" (fol. 34r) in his disagreement with Avicenna as to whether a science can demonstrate the causes of its subject. The result is a typological statement exactly like Averroes': "Non est impossibile quod artifex demonstraret causas sui subjecti nisi per demonstrationem simpliciter et per demonstrationem propter quid, sed per demonstrationem quia non est hoc impossibile" (fol. 34v; cf. Giunta edition, vol. IV, fol. 57A).

<book> of the De anima, question 38)—, holds, in the twelfth <book> of the Metaphysics, question 3,[46] that the Commentator perhaps understood by demonstration *simpliciter* demonstration which is through remote causes, but by demonstration *propter-quid* he understood demonstration which is through a proximate cause. But he, although he was the closest imitator of the Commentator, completely forgetting the teaching of the Commentator, erred more seriously than the others. For the Commentator in every context wished demonstration *simpliciter* to be far more perfect, since it gives cause and existence together. Therefore it is called "absolute" and the most powerful demonstration, as will be made clear immediately by demonstration *propter-quid-tantum*. (**10**) Also, a certain monk expositor of the Commentator, called Urban of Bologna,[47] in the second <book> of this <work>, comment 22, held with Jean that the Commentator understood by demonstration *simpliciter* demonstration *quia*, which is through a remote cause, which can be called demonstration *simpliciter*, i.e., he explains it in a broad sense. But this man erred not less than Jean, as will be clear immediately.

Then Urbanus adduces the first book of the Posterior Analytics on the difference between "quia" and "propter quid". The latter is demonstration "per causas proprias et immediatas," and the former is of two kinds, through the effect or through the remote cause—hence a total of three kinds of demonstration, but not exactly Averroes' three kinds.

Finally, the two trios are conflated when Urbanus then repeats Averroes' dictum, this time in his own terms derived from the Posterior Analytics: "Modo dicit commentator quod nullus artifex potest demonstrare causas sui subjecti per demonstrationem propter quid, nec per *demonstrationem quia, que est per causam remotam que potest dici demonstratio largo modo*, sed per demonstrationem quia que est per effectum et per accidentia propria continentia ipsum subjectum" (fol. 34v, italics added). Thus in the parallel between the two passages, demonstration simpliciter corresponds to the italicized definition, which turns up in d'Afeltro as "demostrationem quia que est per causam remotam que potest dici demostratio simpliciter, id est, largo modo exponit" (see Latin text below, 98).

It remains unclear, however, why d'Afeltro does not refer to Urbanus on *Physics* i, comm. 2, where he also discusses Averroes' three kinds of demonstration and gives explicit definitions of demonstration *simpliciter*, here distinguishing it from "demonstration of signs" (fol. 3v).

<**II**> Ideo hanc solam dico fuisse Comentatoris mentem: pace aliorum dixerim primo quod Comentator nullam facit differentiam inter demostrationem simplicem et simpliciter, sed solum inter demostrationem simpliciter, signi et propter-quid-tantum. <**A**> Et per signi intellexit demostrationem que ab effectu ad causam procedit—que ideo signi dicitur quoniam per effectum tamquam per medium procedit, qui signum est cause in quantum ipsam significat ipsius similitudinem quodammodo gerens. Dicitur hec demostratio quandoque quia, quando per effectum demostratur propositio de .iii. adiacente (?). Unde per ipsum tunc terminatur quia-est questio, et dicitur quia-est quoniam per ipsam solum concluditur quia est vera. Hoc modo etiam loquendi Philosophus primo Posteriorum utitur cum dicit: "Dupliciter autem necessarium est precognoscere: aliqua namque[l] quia sunt prius opinari necesse est, aliqua vero quid est[m] quod dicitur intelligere oportet; quedam autem utraque, ut quoniam omne quidem[n] aut affirmare aut negare verum est, quia est."[48] Dicitur etiam esse puta quando per effectum demostratur propositio de secundo adiacente, et terminatur questio si-est, ut si per fumum esse demostraretur ignem esse, ut Temistius ait.[49] <**B**> Per demostrationem vero propter-quid-tantum intelligit demostrationem cause tantum, et est illa que non declarat effectum esse nec terminat q<uestionem> quia-est quoniam effectum esse fuit prius notum, sed solum declarat propter quam causam est effectus, et terminat solum q<uestionem> propter-quid, et ideo propter-quid-tantum dicta est—ut si videris lunam eclipsari nesciens adhuc causam; quam investigares, per quam indagatam postea demostrares lunam eclipsari, ut primi philosophi qui ex admirari ceperunt philosophari,

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[l] neque pr. [m] quid est] quidem pr. [n] quid est pr.

[48] 71a11-15. D'Afeltro's text is closest to the James of Venice version ed. L. Minio-Paluello and B. G. Dodd, Aristoteles Latinus, IV.1-4, Bruges/Paris 1968, 5: "Dupliciter autem necessarium est precognoscere; alia namque, quia sunt, prius opinari necesse est, alia vero, quid est quod dicitur, intelligere oportet, quedam autem utraque, ut quoniam omne quidem aut affirmare aut negare verum est, quia est." The "Antiqua translatio" in the Giunta edition, vol. I.2, fol. 17, differs considerably.

[49] Reference not found.

II For this reason, this alone, I say, is the mind of the Commentator: With due respect to the others I would say first that the Commentator makes no difference between simple demonstration and demonstration *simpliciter*, but only between demonstration *simpliciter*, of the sign and *propter-quid-tantum*.

A And by "of the sign" he understood demonstration which proceeds from the effect to the cause—which is called "of the sign" since it proceeds through the effect as though through a middle term, which (effect) is the sign of the cause in as much as it signifies the cause, having a kind of similarity to it. This demonstration is sometimes called *quia*, when through the effect is demonstrated the proposition from the third adjacent (?). Hence the question *quia* is determined and it is called *quia* since only through it is it concluded that it is true. The Philosopher uses this kind of speaking in the first <book> of the Posterior <Analytics> when he says: "It is necessary to know things in advance in two ways: for <in the case of> some things it is necessary first to consider that they are, but <in the case of> other things, one should understand what it is that is being mentioned; but <in the case of> certain things, both <are necessary>, since, for every thing, either to affirm or to deny that it is, is true."[48] It is also said to exist, for example, when a proposition from the second adjacent (?) is demonstrated through its effect and the question "if-it-is" is determined (such as if through the existence of smoke it is demonstrated that fire exists, as Themistius says.[49]

B But through demonstration *propter-quid-tantum* he understands demonstration of the cause only, and that is what does not make clear that the effect exists, nor does it determine the question *quia*, since that the effect exists was known earlier. But it only makes clear because-of-what-cause the effect is, and it determines only the question "*propter-quid*", and therefore it is called *propter-quid-tantum* (such as if you see the Moon being eclipsed, not yet knowing the cause; you investigate the cause; through which, having been investigated, you afterwards demonstrate that the Moon is being eclipsed, like the first philosophers who began to practise philosophy as a resulting of wondering <at things>); in the first

primo Methafisice[50] diceretur ista demostratio propter-quid-tantum. <C> Sed per demo/Bv^{v}/strationes simpliciter intelligit ubique Comentator, tam hic quam .ii. Physicorum co. xxii., xxvi.[51] et .ii. Celi com. xxxv.[52] et primo Kolliget[53] et in Destructionibus et in Methafisica,[54] demostrationem declarantem effectum et propter quam causam effectus sit. Unde causa cum est nobis et nature notior effectu, semper per talem causam poterimus demostratione simpliciter demostrare effectum, sicut universaliter sunt demostrationes mathematice et quandoque naturales. Hoc clare habet Comentator .ii. Celi com. allegato .xxxv. cum ait: "et iam declaratum est in logicis quod demostrationes sunt in quibus itur ex notiori ad latentius. Si igitur notius fuerit posterius, erunt demostrationes quia; et si notius fuerit prius et latentius fuerit suum esse et sua causa notior, erit demostratio absoluta"—id est, simpliciter—"que dat causam et esse; et si latentius fuerit causa rei et non suum esse,[55] erit demostratio propter-quid-tantum."[56] Hec ipse formaliter. Hoc idem habet ipse primo huius comento .ii. cum inquit: "Si contigerit ut notum apud nos sit notum apud naturam, tunc demostrationes date in hac scientia erunt demostrationes cause et esse."[57] Erit ergo demostratio simpliciter secundum

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[50] D'Afeltro's example of a lunar eclipse does not appear in *Metaphysics* i, but he seems to be merging two passages from that book. First, his "Ut primi philosophi qui ex admirari ceperunt philosophari" appears to derive from Aristotle's teaching that science arose from wonder (Metaphysica 982b12-16; Translatio Anonyma, Aristoteles Latinus, XXV.2, 10): "Quia vero non activa, palam ex primum philosophantibus; nam propter admirationem homines et nunc et primum inceperunt philosophari." Secondly, when he says "primo Methafisice diceretur ista demostratio propter-quid-tantum," he appears to have in mind: "Expertes enim ipsum sciunt quia, sed propter quid nesciunt; hii autem propter quid et causam cognoscunt" (*Metaphysics* 981a29-30; Translatio Anonyma, Aristoteles Latinus, XXV.2, 8). This could explain the subjunctive "diceretur": d'Afeltro wishes the text were more precise in refering to "propter quid".

[51] See note 34 above and Giunta edition, vol. IV, fol. 59C.

[52] Giunta edition, vol. V, fol. 118K: "Isti enim orbes, quos ponunt Astrologi, sunt res priores, ex quibus sequuntur posteriores, quae videntur per sensum: & non demonstratur illic quod ab illis posterioribus sequuntur necessario illa priora. Et iam declaratum est in Logicis quod demonstrationes sunt, in quibus itur ex notiori ad latentius. Si igitur notius fuerit posterius, demonstrationes erunt quia. Et si notius fuerit prius et latentius fuerit suum esse, & sua causa notior, erit demonstratio absoluta, quae dat causam & esse. Et si latentius fuerit causa rei quam suum esse, erit demonstratio *propter quid tantum* [our italics]. Et quia prius in istis est latentius, nullus modus est modorum demonstrationum, cum scilicet ex prioribus non sequantur necessario posteriora illa, sed ponuntur ab Astrologis, & si sint ignota."

<book> of the Metaphysics[50] that demonstration should be called *propter-quid-tantum.*

C But by demonstrations *simpliciter* the Commentator understands in every context—as much here as in the second <book> of the Physics, comments 22 and 26,[51] and the second <book> of the De caelo, comment 35,[52] and the first <book> of the Colliget[53] and in the Destruction <of the Destruction> and in the Metaphysics[54]—the demonstration making clear the effect and because of what cause the effect is. Hence when the cause is more known than the effect to us and to nature, we are always able to demonstrate the effect through such a cause by demonstration *simpliciter*, as is universally the case in mathematical demonstrations and sometimes in natural <demonstrations>. This the Commentator clearly states in the second <book> of the De caelo, comment 35 (already referred to), when he says: "And it has also been made clear in logic that demonstrations are <the things> in which one goes from the more known to the more hidden. If, therefore, the more known is later, they will be demonstrations *quia*; and if the more known is prior and its existence is more hidden and its cause is more known, it will be absolute demonstration"—i.e., *simpliciter*—"which gives cause and existence; and if the cause of the thing and not its existence is more hidden,[55] it will be demonstration *propter-quid-tantum.*"[56] This <is what he writes> in a formal way. He has the same in the first <book> of this <work>, comment 2, when he says: "if it happens that what is known to us is known to nature, then the demonstrations given in this science will be demonstrations of cause and existence."[57] It will therefore be demonstration *simpliciter*, according to

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Note the use here in Averroes of "propter quid *tantum*", which d'Afeltro emphasizes, and of "demonstratio absoluta", instead of "simpliciter". The Arabic and the Hebrew for the term "demonstratio absoluta" are quoted from the Epitome (57 and 59 above).

[53] Note that d'Afeltro is using Averroes' medical as well as his philosophical writings. Though d'Afeltro cites "primo Kolliget", he seems to have in mind bk. v, ch. 24, "De modo cognoscendi virtutes Medicinarum, & Ciborum," with its discussion of demonstration drawing explicitly on the *Posterior Analytics* (Giunta edition, Suppl. I, fols. 93v-95v).

[54] See note 45 above.

[55] Giunta edition: "latentius [*sic*]...causa rei quam suum esse" ("the cause is more hidden than its existence").

[56] Giunta edition, vol. V, fol. 118K.

[57] Giunta edition, vol. IV, fols 6M-7A; see 69-70 above.

Comentatorem cum effectum esse latet et per causam notiorem simpliciter et nobis demostramus effectum. Eodem ergo medio in tali demostratione nobis innotescit effectum esse et propter quam causam sit, eademque demostratione utraque questio—et quia-est et propter-quid—absolvitur nobis. Que demostratio dicitur simpliciter, absoluta, demostratio cause et esse atque potissima.

Nam in quantum aggregat in se omnem evidentiam demostrationis et signi et propter-quid-tantum dicitur "simpliciter". Demostratio enim signi demostrat conclusionem esse veram tantum; et demostratio propter-quid-tantum demostrat causam tantum sive propter quid conclusionis. Hec autem demostratio utrumque simul demostrat; utriusque igitur demostrationis evidentiam continet. Dicitur secundo "absoluta" in quantum utramque questionem absolvit. Dicitur tertio "cause et esse" in quantum utrumque ostendit et conclusionem esse veram et propter quam causam est vera. Dicitur quarto "potissima" in quantum potior atque efficatior aliis est. Hoc etiam Temistius confirmat secundo Poste[rio]/Bvi^{r}/riorum Analeticorum capite .ii. cum ait: "Hoc enim demostrationis illius potissime ingenium est ut communi examine utramque absolvat questionem et ut sit et quamobrem sit."[58]

<III> Ulterius adverte quod cum omnis bona divisio debeat bimembris esse vel saltim ad hanc reducibilis, teste Boetio, ista ad bimembrem hoc pacto reduci potest: Omnis demostratio est quia vel propter-quid, ut habet Aristoteles primo Posteriorum capite <terdecimo (?)>. Sed differt quia et propter-quid scire. Ultra demostratio quia subdividitur, quoniam quedam est per effectum convertibilem, quedam per causam remotam. Hoc habet ibi Philosophus in textu cum ait: "Uno modo differre quia a propter-quid si non per non-medium "—id est, per immediata—"fiat sillogismus. Non enim accipitur prima causa sed que est propter quid scientia secundum primam causam."[59] Hoc ipse etiam prope principium primi dicebat: "Ex primis namque et indemostrabilibus est" scilicet demostratio propter-quid

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[58] Themistius, *Paraphrasis in posteriora Aristotelis* (Venice, 1499), fol. 11v: "Hoc enim demonstrationis illius potissimae ingenium est: ut communi examine utranque absolvat cognitionem: & ut sit: & quamobrem sit."

[59] James of Venice version, 78a24-6, ed. Minio-Paluello, 29.

the Commentator, when that-there-is-an-effect is hidden and we demonstrate the effect through a cause more known *simpliciter* and to us. Therefore, by the same medium (means), in such a demonstration, it becomes known to us that there is an effect and because of what cause <that effect> is, and by the same demonstration, both questions—both *quia* and *propter-quid* —are resolved for us. This demonstration is called *simpliciter*, "absolute", "demonstration of cause and existence", and "most powerful".

(i) For in as much as it combines in itself every evidence of demonstration, both of the sign and of *propter-quid-tantum*, it is called *simpliciter*. For demonstration of the sign demonstrates that the conclusion is true only; demonstration *propter-quid-tantum* demonstrates the cause only, or the *propter-quid* of the conclusion. But this demonstration demonstrates both together; therefore it includes the evidence of both demonstrations. (ii) Secondly, it is called "absolute" in as much as it resolves both questions. (iii) Thirdly, it is called "of cause and existence" in as much as it shows both that the conclusion is true and because of what cause it is true. (iv) Fourthly, it is called "most powerful" in as much as it is more powerful and efficacious than others. This Themistius also confirms in the second <book> of the Posterior Analytics, chapter 2, when he says: "For this is the talent of that most powerful demonstration: that it can resolve both questions—that it should be and wherefore-it-is—by a common (single) measure."[58]

III Further, notice that, since every good division ought to be of two parts, or at least reducible to this (as Boethius witnesses), this can be reduced to a two-part <division> in this way: Every demonstration is *quia* or *propter-quid*, as Aristotle holds in the first <book> of the Posterior <Analytics>, chapter <thirteen>. But to know *quia* and <to know> *propter-quid* are different.

(i) Moreover, demonstration *quia* is subdivided, since one kind is through a convertible effect (?), another through a remote cause. This the Philosopher has there in the text when he says: "that *quia* differs from *propter-quid* in one way if a syllogism is not made through a non-middle", i.e., through immediate <terms>. "For <what is> taken is not the first cause but what is *propter-quid* knowledge according to the first cause."[59] He himself said this near the beginning of the first <book>: "For it", i.e., demonstration *propter-quid*, "is from first and undemonstrable <things>,

"quia non sciret non habens demostrationem ipsorum"[60]—scilicet per ipsa. Et primo Thopicorum circa principium, "Omnis," inquit, "demostratio est ex primis et veris vel ex hiis que per ea principium cogitationis sumpserunt."[61] Et adducit[o] Philosophus in Posterioribus .ii. exempla: primum ut per non esse animal demostretur aliquid non respirare[62] vel ex non habere vites demostretur Scitas non sibillare, Anacarside auctore.[63] Et addit Philosophus: "Alio vero modo per non media quidem sed non per causam sed per convertentiam et per notius. Prohibet enim nihil eque predicantium notius esse aliquando non causam, quare per hanc erit demostratio, ut quod prope sint planete propter id quod non scintillant."
Demostratio propter-quid dividitur quoniam quedam est propter-quid-tantum—sive cause tantum—, quedam est propter-quid et esse—sive cause et esse—que demostratio simpliciter dicitur. Unde propter-quid demostratio non contra distinguitur demostrationi simpliciter, quoniam omnis simpliciter est propter-quid et non econverso, sed bene propter-quid-tantum.[64] Non ergo excluditur demostratio simpliciter a divisione demostrationis posita a Philosopho primo Poste/Bvi^v/riorum, capite allegato, quoniam sub propter-quid continetur.

<IV> Ulterius advertendum quod Franciscus Mayronis[65] in conflatu d.ii.

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[o] aducit pr. [p] adit pr.

[60] Ibid., 71b27-9, 7.

[61] *Topics*, 100a26-7.

[62] *Posterior Analytics*, 78b16.

[63] Ibid., 78b30-2.

[64] Compare Burley, *Expositio ... de Physico auditu*, at the place already cited by d'Afeltro (as note 34; bk. ii, comm. 22, fol. 46r): "Et ideo dico quod demonstratio propter quid est in plus quam demonstratio simpliciter. Omnis enim demonstratio simpliciter est demonstratio propter quid, sed non omnis demonstratio propter quid est demonstratio simpliciter."

[65] Franciscus Mayronis (d. 1327), *In primum [-quartum] sententiarum, foecundissimum scriptum*, Venice, 1505-7.
D'Afeltro is in fact referring to questions 2 and 3. In bk i, dist. 2, quest. 2, fol. 16v: "Utrum scilicet deum esse sit demonstrabile propter quid: Ad quod dico quod non, quia in demonstratione propter quid diffinitio subiecti dicendum esse medium. Sed deus non est diffinibilis, quia simpliciter simplex." And then in quest. 3, fol. 16v: "Et ita habeo duos conceptus de deo. Unum entis primi, et alium cause prime. Tunc istis habitis dico quod demonstratione quia poterimus demonstrare deum esse. Sed est intelligendum quod duplex est demonstratio quia. Una a priori, et alia a posteriori. Hoc enim est communis omni demonstrationi quia, quod fiat per passionem acceptam pro medio, contingit autem hoc dupliciter.

because, not having the demonstration of them, he does not know"[60]—that is, <know> through them. And in the first <book> of the Topics near the beginning he says "Every demonstration is from first and true things or from those which they have taken as the principle of thought through them".[61] And in the Posterior Analytics the Philosopher brings two examples: first, that through not being an animal something is shown not to breathe,[62] or through not having vines, the Scythians are shown not to play the flute, on the authority of Anacarsis.[63] And the Philosopher adds: "But by another way through non-middles but not through a cause but through convertence (?) and through <something> more known. For nothing prevents the not-cause of equally predicating <terms> at any time being more known, and therefore through this there will be a demonstration, as that the planets are close for the reason that they do not twinkle."

(ii) Demonstration *propter-quid* is divided, since one kind is *propter-quid-tantum*, or of cause only, another is *propter-quid* and existence, or of cause and existence, which is called demonstration *simpliciter*. Hence demonstration *propter-quid* is not contradistinguished from demonstration *simpliciter*, since every <demonstration> *simpliciter* is *propter-quid* and not the converse, but it is well <described as> *propter-quid-tantum*.[64] Demonstration *simpliciter* is not therefore excluded from the division of demonstration posited by the Philosopher in the first <book> of the Posterior <Analytics>, the aforementioned chapter, since it is contained in <demonstration> *propter-quid*.

IV Further, it must be noticed that Franciscus Mayronis[65] in his Conflatus (?), distinctio 2, question 3, imagined that there is no demonstration

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Aliquando enim contingit quod passio posterior est conclusa a priori, sicut per medium, et sic est demonstratio quia a priori. ... Aliquando enim accidit quod passio posterior est medium ad concludendum priorem, et tunc demonstratio quia est a posteriori."

This is arguably the most interesting source brought to bear on Averroes' Proemium in the *Expositio*. Evidently, it is unremarkable to d'Afeltro that, all of a sudden, the ground of his discussion of demonstration should shift from natural philosophy to theology. (Although d'Afeltro is citing Mayronis to refute him, he does the same with many of his other, non-theological sources as well.) Further, d'Afeltro does not signal this shift to his reader. The context of proving the existence of God is gone from his discussion of Mayronis on demonstration. Here, then, is an example of how an Averroistic commentator in a 16th-century Italian philosophy and medical faculty could read a theological work in order to think about problems of method in natural philosophy—and an example of how he might read and represent such a work untheologically.

q.iii. imaginatus est nullam esse demostrationem propter-quid nisi istam in qua medium est diffinitio subiecti. Sed omnis demostratio in qua medium est diffinitio passionis vel passio—sive fuerit prior sive posterior—erit quia. Unde posuit demostrationem quia per causam immediatam etiam procedentem esse duplicem: unam a priori—puta quando per passionem priorem demostratur posterior—, aliam a posteriori—puta econverso. Que opinio contra communem opinionem et contra Aristotelem est. Nam licet Aristoteles demostrationem quia-a-priori posuerit—puta quando per causam remotam demostratur effectus—et quia-a-posteriori—puta cum per effectum convertibilem demostratur causa, ut supra ostensum, numquam tamen dixit Aristoteles quod, cum per passionem priorem demostratur posterior sibi, inmemata (entimemata?) quod ista sit quia, immo, propter-quid. Aliter multe demostrationes mathematice cum huiusmodi sint essent quia, contra Comentatorem .ii. Prime Philosophie comento .xvi. ponentem illas in primo ordine certitudinis.[66]

<V> Ulterius advertendum quod Comentator ubique has modos appellat, quoniam demostratio de hiis analogice predicatur: per prius namque perfectiusque de simpliciter que potissima est predicatur; secundo de propter-quid-tantum; tertio de quia, ut primo Posteriorum habet magis inquiri.[67]

Et addit[q][68] Comentator: "quamvis signum et causa sit plus usitata in hac scientia et aliquando est usitata demostratio simpliciter". Hoc idem dicit ipse in hoc primo com. ii. supra allegato[69] et primo De anima comento .x. cum ait: "Oportet in hac inquisitione ire ex hiis que sunt magis nota apud nos ad ea que sunt latentiora apud nos et in hoc differunt scientie. Scientiarum enim in quibusdam ea que sunt magis nota apud nos sunt precedentia, ut in mathematicis; in quibusdam vero econverso, sicut in quibusdam que continentur in scientia naturali."[70] Ubi est advertendum

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[q] addit pr.

[66] Giunta edition, vol. VIII, fol. 35L.

[67] D'Afeltro may have in mind chapter 13, on the difference between knowledge of the fact and knowledge of the reasoned fact, to which he does not otherwise refer.

[68] Note that d'Afeltro returns here to the text of the Proemium.

propter-quid except that in which the middle <term> is the definition of the subject. But every demonstration in which the middle <term> is a definition of a passion or a passion—whether it is prior or later—will be a <demonstration> *quia*. Hence he posited that demonstration *quia* through an immediate cause <which is> also preceding (?) is double: one *a priori*—e.g., when a later passion is demonstrated through an early one—, the other *a posteriori*—e.g., the converse. This opinion is contrary to the common opinion and contrary to Aristotle. For although Aristotle posited a demonstration *quia-a-priori*—e.g., when an effect is demonstrated through a remote cause—and *quia-a-posteriori*—e.g., when the cause is demonstrated through a convertible effect as has been shown above, never however did Aristotle say that, when, through an earlier passion, is demonstrated one later than it, is it inferred (?) that that is a <demonstration> *quia*—rather it is a <demonstration> *propter-quid*. Otherwise many mathematical demonstrations, since they are of this kind, would be *quia*, contrary to the Commentator in the second <book> of the First Philosophy, comment 16, putting them in the first order of certainty.[66]

V Further, it should be noticed that the Commentator in all contexts calls these "kinds (methods)", since demonstration is predicted of these analogically: for through the prior and more perfect one speaks of the *simpliciter* which is most powerful; secondly of the *propter-quid-tantum*; thirdly of the *quia*, as there is more to find in the first <book> of the Posterior <Analytics> (?).[67]

And the Commentator adds:[68] "although sign and cause are more used in this science; and sometimes demonstration *simpliciter* is used." He says this same thing in this first <book>, comment 2 (already mentioned)[69] and in the first <book> of the De anima, comment 10, when he says: "It is necessary in this enquiry to go from those which are more known to us to those which are more hidden to us and in this sciences differ. For of sciences in certain ones those things which are more known to us are preceding, as in mathematics; in certain ones the opposite, as in certain things which are contained in natural science."[70] Here it should be noticed that sometimes in natural <sciences> the cause is more known to us and

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[69] Giunta edition, vol. IV, fols. 6M-7A.

[70] Giunta edition, Suppl. II, fols. 4F-5A.

quod aliquando in naturalibus causa est magis nota nobis et simpliciter,[71] sicut de obiecto sensibili et specie[s] ab eo /Bvii^{r}/ causata, vel de re sensibili et intentione universali[s] ab eo causata, vel de substantia ignis et eius potentia activa a tali substantia causata. Patet hoc modo etiam apud Comentatorem: potest subiectum naturalis philosophie esse notius nature et nobis sua propria passione.

simpliciter,[71] just as concerning the sensible object and the species caused by it, or the sensible thing and the intention of the universal (?) caused by it, or the substance of fire and the active potency caused by such a substance. It is clear in this way also with the Commentator: it is possible for the subject of natural philosophy to be more known to nature and to us by its proper passion.

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Pietro d'Afeltro and his students were not the only ones at Naples in the first years of the sixteenth century busy with the problem of method in the *Physics*. There was also Agostino Nifo, recent editor of one of the earliest editions of Aristotle with the commentaries of Averroes, and soon to be known as a prolific writer on logic. Just before d'Afeltro was to teach the *Physics* with special attention to Averroes' pronouncements on method, Nifo was writing his influential *Physics* commentary, which he finished in 1506.[72]

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[s] spe. pr.

[71] In his final observation—"Ubi est advertendum quod aliquando in naturalibus causa est magis nota nobis et simpliciter"—d'Afeltro contradicts Aristotle. Compare in the opening of the *Physics*: "non enim eadem nobisque nota et simpliciter" (Translatio Vetus, Aristoteles Latinus, VII.1, 5). He also contradicts Averroes in this context, who follows the Philosopher closely here (Giunta edition, vol. IV, fol. 6M): "illa, quae sunt cognita apud nos in rebus naturalibus, non sunt illa, quae sunt cognita simpliciter, id est naturaliter." The usual exception to this rule is in mathematics (see citations in *Tabula Zimarae*, Giunta edition, Suppl. III, fol. 232), yet d'Afeltro finds other kinds of exception.

[72] Biographical information on Nifo from Lohr, *Latin Aristotle Commentaries, II: Renaissance Authors*, Florence 1988, s.n., and E. P. Mahoney, "Nifo, Agostino," in: C. C. Gillispie (ed.), *Dictionary of Scientific Biography*, New York 1974, vol. 10.

Nifo had arrived in Naples around 1500. He had also received part of his early education there, in the late 1480s, at exactly the time when d'Afeltro, six years his senior, began to teach metaphysics at the university. Later, both taught philosophy and medicine there. Both had some association with the Neapolitan humanistic circle of Giovanni Pontano.

Italian Aristotle commentators of the early sixteenth century had trouble interpreting Averroes' discussions of method.[73] First among these difficulties was a simple inconsistency with Aristotle. The Philosopher divided demonstration into two kinds—demonstration *quia* and demonstration *propter quid*—whereas the Commentator added a third kind, demonstration *simpliciter.* The central task of d'Afeltro's *Expositio*, or of the disproportionate part devoted to the *via doctrinae*, was to reconcile these two views. D'Afeltro's solution, like that of some other commentators,[74] was to make Averroes' demonstration *simpliciter* a subset of Aristotle's demonstration *propter quid.*

In reaching this solution, d'Afeltro pared away a host of encrusted meanings from the concept of demonstration *simpliciter.* The major views he rejected were: first, that "demonstratio simpliciter" refers to demonstrations whose middle terms combine all kinds of causes (Gaetano da Thiene, Walter Burley, the Archbishop of Amalfi) or which start from remote causes (Jean de Jandun, Urbanus Averroista); and second, that there is no difference between demonstration *simpliciter* and demonstration *propter quid*, but that there is a difference between demonstration *simpliciter* and demonstration *simplex* (Paul of Venice and others). Citing Averroes persuasively against these various commentators, d'Afeltro narrowed the definition of demonstration *simpliciter* to that which simultaneously renders both cause and existence, both *propter quid* and *quia.* His *Expositio* thus reveals him to be a purist interpreter of Averroes on method.

An irony at the heart of the exposition gives away the nature and motives of this purism: demonstration *simpliciter*, after all the attention d'Afeltro lavishes on its correct definition, is nearly useless in natural philosophy. The only way in which knowledge *quia* and knowledge

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[73] See W. Risse, *Die Logik der Neuzeit*, Stuttgart-Bad Cannstatt 1964, vol. i, ch. 4, especially 210-1 and 228.

[74] For example, Thomas de Vio Caietanus; see Risse (as note 73), 210-1.

propter quid can be obtained simultaneously, as in d'Afeltro's understanding of demonstration *simpliciter*, is when we start from things both more known to us and more known to nature. Yet as Aristotle writes and Averroes elaborates in the Proemium and elsewhere, this is almost never the case, except in mathematics. Clearly something other than the actual use of demonstration *simpliciter* is at stake here, and it appears to be the legitimacy and value of Averroes' pronouncements on method *tout court*. That is why the *Expositio* has the feel of a formal and bibliographical exercise. Where Nifo was worried about how to achieve *scientia*, d'Afeltro was worried about order and textual authority.[75] It is likely that Averroes and his ideas would have been debated at Naples after Nifo moved there from the center of Averroism at Padua and began to push these ideas toward more powerful methods. In the context of such a debate, d'Afeltro's *Expositio* was not only an exposition, but a defense of Averroes. It reads less as "radical Aristotelianism" than as conservatism, reconciling the Commentator with the Philosopher, and saving the Commentator from *his* commentators.

D'Afeltro's conservatism helps to explain one of the surprises of the hitherto unstudied *Expositio*: that it says not a word about the demonstrative regress.[76] There are four reasons to expect at least some comment from him about this supposedly most thorough of methods in natural philosophy. First, the double procedure in demonstration was characteristic of Averroist commentary; and "regress", an Averroistic term. Secondly, the passage on method in the Proemium to the *Physics* was traditionally central to such discussion. Thirdly, as we have seen, d'Afeltro's *Expositio* was produced side by side with what has been called "the fullest account"[77] of *regressus* to that date, in Nifo's *Physics* commentary of 1506. Finally, d'Afeltro saw himself as heir to a tradition of relevant, if often errant, commentary that is exactly the tradition supposed to have developed the method of *regressus*.

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[75] An example of how d'Afeltro is guided more by order than by the search for method is that he subdivides demonstration *quia* and demonstration *propter quid* into two kinds each—on the principle, from Boethius, that "every good division ought to be of two parts" (102 above).

[76] D'Afeltro clearly meant his exposition of Averroes on the *via doctrinae* to be comprehensive. Not only is Averroes' demonstration *simpliciter* reconciled with Aristotle, but each of the two basic kinds of demonstration is subdivided and explicated for its own sake.

[77] J. H. Randall, Jr., *The School of Padua and the Emergence of Modern Science*, Padua 1961, 42.

Indirectly, the concept of *regressus* may indeed have left its imprint on d'Afeltro's interpretation of demonstration *simpliciter*. In *regressus*, knowledge *quia* and knowledge *propter quid* are achieved in succession; in d'Afeltro's purified understanding of demonstration *simpliciter*, they are achieved simultaneously. So it is plausible that his reduction of demonstration *simpliciter* to demonstration rendering simultaneously cause and existence, *propter quid* and *quia*, reflects the contemporary reduction of method to the combination of those two *viae* in *regressus*, exemplified by the work of his colleague Nifo.

Yet there is a more general conclusion to be drawn from the fact that a reader of the *Expositio* could not learn from it that such a thing as *regressus* existed. D'Afeltro's bibliography in 1507 is the same as the bibliography of John Randall's classic account in 1940 of the development of *regressus* as the method of early modern science.[78] It begins with Jean de Jandun in about 1315 and goes on to Urbanus Averroista, Jacopo da Forlí, Walter Burley, Paul of Venice, and finally Gaetano da Thiene in the mid 15th century. To this, Randall added only Pietro d'Abano and Ugo Benzi. Whatever the later significance of *regressus* to Galileo, d'Afeltro's *Expositio* corrects our view of what was happening in those two centuries of Averroist Aristotle commentary on method before Nifo: simply put, the tradition led to d'Afeltro as well as to Nifo. It did not necessarily lead to a theory of demonstrative regress as the method of natural philosophy.

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[78] Idem, "The Development of Scientific Method in the School of Padua," in: *Journal of the History of Ideas* 1 (1940), 177-206; revised version published in Randall, *The School of Padua* (as note 77), 15-68.

METHOD IN THE ARISTOTELIAN TRADITION: TAKING A SECOND LOOK

Eckhard Kessler

1 The two phases of the Aristotelian discussion on method

From the time of the first systematisation of the *Corpus Aristotelicum* by Andronikos of Rhodes[1] in the first century BCE and the beginning of systematic teaching of the Aristotelian philosophy in the schools of the Neoplatonists from the third century CE onwards,[2] that is, from the very origin of the Aristotle commentary tradition, Aristotle was approached by starting from his logical works, regarded as representing the *Organon*, the general instrument of philosophical and scientific argumentation, and continuing with the teaching of the practical and theoretical disciplines, that is, ethics, physics and metaphysics. This same ancient scheme was basically preserved in the universities of the Middle Ages and the Renaissance, where the teaching of philosophy in the arts faculty paved the way for the "business schools" of theology and medicine. The same scheme also shaped the career of the successful professor, which began with the chair of logic, continued with natural philosophy and metaphysics and ended with the professorship in theology or medicine, as we can see from the biographies of almost all the Aristotle commentators collected by Charles Lohr.[3] Consequently it was the Aristotelian *Organon* to which anyone in need of methodological advice turned. Demonstration, taught in the *Posterior Analytics* as the only sound road to true knowledge, was regarded the one and only instrument of science. Aristotle's discussion of the different kinds of demonstration—those based either upon knowledge of the causes of the demonstrated fact or those based upon knowledge of what is or is not the immediate cause of the demonstrated fact[4]—became the nucleus of a more detailed Aristotelian methodology. Thus the methodological procedure, which under the name of *regressus* was to become the famous achievement of the Aristotelian tradition, was developed in logical commentaries and questions to the *Posterior Analytics* I, 13 and, to a lesser extent, in those to the first chapter of the *Physics*, where Averroes,[5] transferring the question from the *Analytics*, had discussed it for a second time. When modern scholars became interested in the methodological discussion within the Aristotelian tradition of the Renaissance, they concentrated upon precisely these parts of the commentary tradition.[6]

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[1] See F. Ueberweg, *Grundriß der Geschichte der Philosophie: Die Philosophie der Antike*, vol. 3: H. Flashar (ed.), *Ältere Akademie, Aristoteles—Peripatos*, Basel 1983, 191-2.

[2] I. Hadot, "La division Néoplatonicienne des écrits d'Aristote," in: J. Wiesner (ed.), *Aristoteles. Werk und Wirkung. Paul Moraux gewidmet.* vol. II: *Kommentierung, Überlieferung, Nachleben*, Berlin 1987, 249-85. See for instance Ammonius, *In Aristotelis Categorias Commentarius*, ed. A. Busse (*Commentaria in Aristotelem Graeca* IV, iv), Berlin 1895, 5, 31-6, 20.

[3] C. H. Lohr, "Medieval Latin Aristotle Commentaries," in: *Traditio* 23 (1967) to 35 (1974); idem, "Renaissance Latin Aristotle Commentaries," in: *Studies in the*

Yet, as is obvious from the mere fact that the *regressus* could become the subject of a commentary to the *Physics* as well, the *Organon* is not the only text where Aristotle deals with the methodological problems of the sciences. Besides some scattered remarks in the first chapters of the *Nichomachean Ethics*, there are three prominent passages in his writings on natural philosophy and science where Aristotle re-examines his logical concept of method in the light of the fields in which it is to be applied and to which it therefore must be accommodated. These are the opening chapters of the *Physics*, of *De anima* and of *De partibus animalium.*[7]

Renaissance 21 (1974) and *Renaissance Quarterly* 28 (1975)–35 (1982), reprinted as *Latin Aristotle Commentaries II: Renaissance Authors*, Florence 1988.

[4] See Aristotle, *Analytica posteriora* I, 13; 78a22-79a16

[5] Averroes, "Commentarium in primum Aristotelis librum de physico auditu c. 2-3," in: *Aristotelis Opera cum Averrois commentariis*, Venice 1562-74 (repr. Frankfurt 1962) vol. IV, 6L-7G,

[6] See J. H. Randall, "The development of scientific method in the school of Padua," in: *Journal of the History of Ideas* 1 (1940) 177-206, reprinted in idem, *The School of Padua and the Emergence of Modern Science*, Padua 1961; Giovanni Papuli, "La teoria del *regressus* come metodo scientifico negli autori della scuola di Padova," in: L. Olivieri (ed.), *Aristotelismo Veneto e scienza moderna*, 2 vols., Padua 1983, 221-77.

[7] *Physics*, 184a10-b14; t.c. 1-5; *De anima*, 402a1-403b19; t.c. 1-18; *De partibus animalium*, 639a1-646a4.

Two of these passages—the introductions to the *Physics* and to the *Books on the Soul*—formed part of the traditional course of natural philosophy. Any professor advancing from logic to natural philosophy had to comment on these passages. He might have just repeated the methodological teaching he had offered as a professor of logic, but he might also have used this chance to review his reflection on method in a new biographical situation and philosophical context and so to transform his former teaching on method in view of the particular subject matter to which it was to be applied.

The third text, the first book of *De partibus animalium*, never formed a part of the course of natural philosophy. It is consequently the subject of far fewer commentaries and its particular role in the sixteenth century discussion on method has still to be determined. Yet, whatever that role might have been, this passage provided a series of genuine Aristotelian arguments for those who were not content with the traditional teaching on method. Thus, like the other two passages, it allowed a second look to be taken at the question of method.

This second look at method in the Aristotelian tradition went beyond the limits of the formal analysis of scientific procedure and argumentation according to the teaching of the *Posterior Analytics*, which ended in the theory of *regressus*. Hitherto, so far as I know, it has not been analyzed in a thorough and systematic way. Given the great number and extent of commentaries and questions to the first two and the numerous hidden references to the third of the related texts, it will be impossible in the course of this paper to deal with this second look as it deserves. All that can be attempted is to shape the field of research by pointing to the questions that were raised, the discussions that arose, and the answers that were given in the context of this methodological reflection and which seem to be worth further consideration. To this end I shall first briefly describe the argumentation of each of the three passages under consideration and then indicate some of the more striking aspects of the commentary tradition.

2 The introduction to the *Physics*

The shortest of Aristotle's texts to be considered here is the first chapter of the first book of the *Physics*. Its brevity, however, neither diminishes its interest for commentators nor reduces the extent of the commentaries: when in 1558 the Bolognese Ludovicus Boccaferrea published his commentary to the first book of the Physics,[8] he devoted 23 lectures or 63 folio pages to the exposition of the 22 lines which make up this chapter in the Bekker edition. An analysis of this commentary in comparison with Aristotle's original text would give some insight into the techniques and methods of such exuberant commentary in late Aristotelianism.

Aristotle's teaching in this chapter is divided into two parts. In the first[9] he argues that since science in general depends on knowledge of the principles, causes and elements, natural philosophy must also start with these definitions. Moreover, he maintains that since what we know and what is manifest to us is not identical with what is known and manifest by nature, natural philosophy has to start with what is known to us. Both these methodological principles are also fundamental to the *Posterior Analytics*,[10] yet, confronted with each other as they are here, they manifest with particular clarity the crucial problem of how science in general and science of nature in particular is possible at all in the context of the Aristotelian tradition.

In the second part[11] Aristotle tries to answer this problem, maintaining that what is first known to us is known by sense perception and presents itself as something *poured together—synkechyménon*—or *confused*. Thanks, however, to the process of division, through which the whole is divided into its distinct constitutive parts, and the universal is divided into those distinct species or individuals that are subsumed under it, the elements and principles become known as well.

It is not surprising that in the context of a tradition which used the commentary on and the question to a given text as the main instruments of philosophical and scientific development, Aristotle's summary of the application of his own methodological teaching to natural philosophy occasioned various questions, especially questions about the relation of science as such to the various individual sciences and to the science of nature in terms both of their different starting points, or *primum cognitum*, and of their appropriate procedures and methods. In Averroes' exposition we find an attempt at such a systematic reconstruction of Aristotle's methodological teaching with special regard to the different speculative sciences.[12] It would be worthwhile investigating to what extent and with what results his ideas were transmitted to and received in the Renaissance commentaries. Moreover, Averroes makes some specific points whose fortune in the Aristotelian tradition deserves careful consideration. For example, he takes it for granted that the methodological problem of the *Physics* is a matter only for the teacher of natural philosophy and science, that is, for someone who wants to bestow science of nature on somebody: *qui vult largiri scientiam de natura.*[13] In Averroes' understanding method is thus restricted to the method of teaching and all methodological problems of discovery are expressedly excluded from his reflections. Given the *Commentator*'s enormous impact on the Aristotelian tradition right up to the end of the sixteenth century,[14] one is driven to ask when, why, and by whom the need to complete the concept of method with a method of discovery and research was first felt and what consequences this had for the interpretation of the first chapter of the *Physics.*

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[8] Ludovicus Buccaferrea (1482-1545), *Expositio super librum I Physicorum*, Venice 1558; see C. H. Lohr, *Latin Aristotle Commentaries II: Renaissance Authors*, Florence 1988, 57-8.

[9] Aristotle, *Physics* I,1; 184a10-21 (t.c. 1-2).

[10] See Aristotle, *Posterior Analytics* I,2; 71b2, 71b34.

[11] Aristotle, *Physics* I,1; 184a21-b14 (t.c. 3-5).

Another point which needs closer consideration seems to originate from a textual problem. At the beginning of the second part, according to its Latin translation, Averroes' text of the *Physics* says that "those things which are first evident and manifest to us are the mixed things (*mixta*), the real composite ones (*composita proprie*) later, however, and out of them the elements and principles are ultimately rendered manifest (*efficiuntur manifesta*) to us."[15] Consequently it is clear that, for Averroes, "that which is known to us" is the effect of a process of composition, and, since the text does not give other indications, it must be assumed that the process which leads to the knowledge of elements and principles of such composites is the *demonstratio signi* or *quia*,[16] that is, the demonstration of the fact, or the first part of the *regressus*. Thus in Averroes' systematic interpretation there is no doubt that at the beginning of the *Physics* Aristotle is recommending the *regressus* as being the appropriate scientific method. However, the Latin translation of Argyropulos—following, in fact, the Greek—renders Aristotle's text differently: "But the confused things (*confusa*) are at first better known to us and more manifest; the elements, however, and principles are used to become known to us later on the basis of these through their division (*per ipsorum divisionem*)."[17] This text speaks, not of mixed bodies which have to be resolved into their elements, but of something confused and undistinguished that has to be made distinct;[18] it clearly sees, not some kind of demonstration or the *regressus*, but division, Aristotle's method of arriving at the definition found in the *Posterior Analytics*,[19] as the appropriate method to start with in natural science.

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[12] Averroes, *Commentarium in primum Aristotelis librum de physico auditu*, in: *Aristotelis Opera cum Averrois commentariis*, Venice 1562-74 (repr. Frankfurt 1962) vol. IV.

[13] Averroes (as note 14), c.1, 6G, and see also c. 2; 6K; c. 4; 7F: "oportet incipere in ordine doctrinae..."

[14] See C. B. Schmitt, "Renaissance Averroism Studied Through the Venetian Editions of Aristotle-Averroes (with Particular Reference to the Giunta Edition of 1550-52)," in: *L'Averroismo in Italia*, Rome 1979, 121-42

[15] Averroes (as note 14), t. 3, 7B-C: "Et illa, quae primo sunt apud nos evidentia et manifesta sunt mixta, s. composita proprie: deinde in postremo efficiuntur nobis ex istis elementa et principia manifesta".

It seems that most of the Aristotelian tradition followed the interpretation of Averroes. Nevertheless, under the impact of Aristotle's Greek text and Argyropulos' new Latin translation, at some point between Pomponazzi and Jacopo Zabarella[20] the notions of the *confused* and the *distinct*, as used in the introduction to the *Physics*, seem to replace or at least to supplement those of the *effect* and the *cause* as signifying the extremes of the regressive process. It would be interesting to know who was responsible for this transformation, what the reasons for it could have been, and what its implications and consequences were.

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[16] Ibid., c. 4, 7F: "propter quam fuit necesse ut demonstrationes huius scientiae fuerint signa."

[17] Aristoteles, *Physica auscultatio, Ioanne Argyropulo Byzantino interprete* I,1; 184a21-23, in: *Aristoteles Latine, interpretibus variis*, Berlin 1831 (repr. Munich 1995), 102a: "At confusa primo nota nobis sunt magis ac manifesta; elementa vero principiaque posterius ex hisce nota per ipsorum divisionem fieri solent."

[18] See ibid., 102b2: "totum enim quoddam *indistinctumque* significant." 102b14: "posterius autem horum utrumque discernere *distinguereque* videntur."

[19] Aristotle, *Posterior Analytics* II,5; 91b12 ff; II, 13; 96a20 ff.

[20] Jacopo Zabarella (1533-1589), "Liber de regressu," Cap. III, in: *Opera logica*, Cologne 1597, repr. Hildesheim 1966, 483F-484A: "contingere potest ut effectus sit *confuse* notus, quia ipsius causa ignoretur; tunc igitur duo sunt, que demonstratione indigent, causa quidem demonstratione eget, qua dari ostendatur; effectus vero demonstratione eget, qua *distincte* per suam causam cognoscatur."

Even the concept of division as being the appropriate method to start with in natural science was not entirely lost. Johannes Philoponos, whose commentary to the *Physics* was printed in Latin translation nine times between 1539 and 1581[21] and, according to Charles Schmitt,[22] was widely used during the sixteenth century, demonstrates this clearly. I have come across at least one other author on method who does not hesitate to count division of the whole and division of the universal, as described in the beginning of Aristotle's *Physics*, as legitimate methods besides demonstration and definition, namely Pedro Fonseca.[23] The question of to what extent and with what result those Aristotelians who are known to have used Philoponos' commentary on the *Physics* used his methodological teaching would be a promising area of investigation.

3 The introduction to the *De anima*

The second of our Aristotelian texts, the introduction to the *Books of the Soul*, is about five times longer than the first chapter of the *Physics*—102 lines in Bekker's edition—but has not been commented on less frequently. As a whole, it seems to be divided into a prelude, three parts, and a coda. The prelude praises psychology above the other sciences because of its excellence and utility.[24] The first part defines the task of psychology—to get to know the essence and the properties of the soul—and defines its methodological problem—how to arrive at knowledge of the essential definition of the soul, from which the soul's properties could be derived.[25]

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[21] Johannes Philoponus, *Commentaria in libros Physicorum*. Interprete Guillelmo Dorotheo, Venice 1554, repr. Frankfurt 1984.

[22] C. B. Schmitt, "Philoponos' Commentary on Aristotle's *Physics* in the 16th Century," in: R. Sorabji (ed.), *Philoponus and the Rejection of Aristotelian Science*, London 1987, 210-30.

[23] Pedro Fonseca (1528-1599), *Institutionum Dialecticarum libro octo* I.4, ed. J. Ferreira Gomes, Coimbra 1964, 24: "Tres autem sunt generales disserendi modi, qui deinde in alios atque alios minutius conciduntur: Divisio, inquam, Definitio, et Argumentatio." See also ibid., IV,4; 256: "Divisio, ut a distinctione vocis multiplicis, et a partitione secernitur, duplex est, altera totius essentialis, altera totius universalis. Nomine totius essentialis intelligo id, quod habet essentiam compositam ex materia et forma communi aut ex genere et differentia... . Totum vero universale accipio respectu partium, quae illi subiiciuntur essentialiter, seu de quibus illud dicitur ut de subiectis... ." See Lohr (as note 10), 150-1.

[24] Aristotle, *De anima* I,1; 402a1-7 (t.c. 1-2) .

[25] Ibid., 402a7-22 (t.c. 3-5).

The second part tries to arrive at the definition of the soul by way of division, discusses the problems with which such an approach meets, and concludes with the insight that an appropriate definition of the soul depends on an appropriate knowledge of its properties.[26] The third part exposes the problems which present themselves to whoever wants to deal with the properties of the soul with special regard to their relation to the body.[27] Finally, the coda distinguishes between the different sciences according to the form of their definitions and argues that the soul belongs to the subject matter of the natural philosopher.[28]

Taken as a whole, this text can be read as an application of Aristotle's general methodology to the special case of the soul, and this seems to have been the way that the "systematic" commentators such as Averroes and his followers understood it. It may, however, also be regarded as a re-examination of the general concept of method in view of the special case of the soul. In an era of changing attitudes, some of its aspects and arguments could well serve as stepping stones to new hypotheses and developments. I submit that this was indeed the case in sixteenth-century discussions of this text and should like to draw the attention to some points which seem to be of special interest.

Right at the beginning of the treatise, Aristotle formulates two criteria for the hierarchy of the sciences: exactness of the proof and dignity of the object.[29] There seems to have been no discussion of the second criterion, that the nobility of a science depends upon the ontological status of its subject matter. The first one, however, met with various interpretations. The Greek word is *akríbeia*; in different passages from the *Metaphysics* this quality is predicated of the sciences either because of the ontological primordiality of their objects[30] or because of the exactness of their procedures.[31] Consequently this criterion may either be another ontological one, in which case the hierarchy of sciences depends solely on the dignity of their subject matter, or it is a methodological one, so that there are two competing criteria for the order of the sciences. Agostino Nifo chooses the first option, justifying his decision from the Greek commentary tradition;[32] the *Commentator*, who understands the first criterion to be the *confirmatio demonstrationis*, chooses the second.[33] Averroes seems to have been widely followed.

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[26] Ibid., 402a23-403a2 (t.c. 6-11).

[27] Ibid., 403a3-25 (t.c. 12-4).

[28] Ibid., 403a25-403b19 (t.c. 15-8).

[29] Ibid., 402a1-3 (t.c. 1).

[30] See Aristotle, *Metaphysics* I,2; 982a25 (Bessarione interprete), in: *Aristoteles Latine, interpretibus variis* (as note 19), 482a: "scientiarum autem illae certiores sunt, quae maxime primorum sunt. nam quae sunt ex paucioribus, certiores iis sunt, quae ex additione dicuntur."

One of these followers is Pietro Pomponazzi, who in a question of his commentary to the *De anima* from 1504 uses this understanding to develop two independent hierarchies of the sciences: the first is that of the sciences as such, based on the ontological criterion, and the second that of the siences *quoad nos*, in relation to us, based on the methodological criterion.[34] In the latter, Pomponazzi argues, one might doubt whether natural philosophy exceeds mathematics, since, on the one hand, natural philosophy starts with *sensibilia propria*, which do not allow for error, while mathematics starts with *sensibilia communia*, which do, and, on the other, mathematics starts with *causae sensatae*, which allow for real science, while natural philosophy starts only with *effectus sensati*, which do not. Moreover there is certainly no doubt that in the hierarchy of sciences *quoad nos* the place of metaphysics is the last, because metaphysics is not based on sense perception at all.[35]

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[31] Ibid., II, 3; 995a15-16: "certitudinem (*akribologían*) vero mathematicam non oportet in cunctis quaerere, sed in iis, quae non habent materiam. quare non est naturalis modus: tota enim natura forte habet materiam."

[32] Agostino Nifo (1469/70-1538), *Expositio subtilissima necnon et collectanea commentariaque in libros Aristotelis De anima* t.c.1, Venice 1559, col. 3: "Et cum hoc ita sit, patet secundum expositionem Graecorum, quod Aristoteles non anteponit hanc scientiam aliis propter firmum genus demonstrandi et nobilitatem subiecti, ut Averroes et latini consentiunt, sed propter constantiam subiecti et eius nobilitatem..." See also col.12: "hoc stante dico Aristotelem scientiam hanc de anima caeteris philosophiae naturalis partibus praeposuisse solum praestantia subiecti."

[33] Averroes Cordubensis, *Commentarium magnum in Aristotelis De anima libros* I, c. 1, 9ff., ed. F. Stuart Crawford, Cambridge, MA 1953, 3: "Intendit per *subtilitatem* (that is his translation of the Greek *akríbeia*) confirmationem demonstrationis."

[34] Pietro Pomponazzi, *Expositio super I «De anima» Aristotelis et Commentatoris quam fecit anno 1504*, ed. L. Olivieri, in: Luigi Olivieri, *Certezza e gerarchia del sapere. Crisi dell'idea di scientificità nell'Aristotelismo del secolo XVI*, Padua 1983, 177-92; 180: "quaeritur tertio loco, a quonam scientia sortiatur magis nobilitatem, a subiecto an a modo et certitudine demonstrationis. ... scientia dignior est subiecto quam a modo... nam modus demonstrandi est quid accidens scientiae et est qoad nos, sed subiectum est de essentia scientiae: causat enim scientiam."

Pomponazzi's use of the double criterion is remarkable and both its reception and its relation to the transformation of natural philosophy (which has been demonstrated by Charles Lohr) would seem to deserve further attention.[36] It would also be interesting to know whether Pomponazzi's concept of mathematics as starting from the senses, which we meet again in Galileo's understanding of mathematics as *scientia humana*—human science—and therefore "derived from sense experience,"[37] indicates any special role for Pomponazzi in the emergence of modern science.

A second, more general, problem arises when Aristotle continues his discussion by praising the utility of psychology because of its conspicuous contribution *pròs alétheian hápasan, ad veritatem omnem*, or, "to the advance of truth in general," as the English translation has it.[38] Does this mean, as Themistius supposed[39] and Nifo claimed also for Theophrastus,[40] that Aristotle is speaking of the *anima mundi*, the world soul, which is the cause and origin of every motion and every body in nature. If so, this would be the gateway by which Neoplatonic cosmology was introduced into the Aristotelian philosophy of nature. Or does it mean, as Averroes[41] and Nifo[42] believed, that the soul is itself the origin and basis of all science, since it contains the ideas and principles of knowledge. In this case a psychological theory of knowledge such as that found in Aristotle's teaching on the intellect in the *De anima* and the *Posterior Analytics* as well as that found in the Neoplatonic tradition would appear to be at the very least a necessary supplement to the theory of science and scientific method. Are there any cross-fertilizations to be found between the vital discussions of the sixteenth century on the doctrine of the intellect and those on the problem of method? And what can be said about the relation between these?[43]

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[35] Ibid., 182: "Item probo quod naturalis praecedat ipsam divinam, nam naturalis praecedit per sensibilia propria et communia, metaphysica autem per abstracta; sed certiora sunt, saltem quoad nos, sensata quam illa abstracta et universalia, quare etc... . Nam probo quod naturalis praecedat mathematicum, quia naturalis procedit per sensibilia propria, mathematica autem procedit per sensibilia communia; sed circa propria sensibilia non cadit error, circa autem communia cadit error: igitur certior est cognitio naturalis quam mathematica, quare etc." Also 183-4: "Prima igitur quoad nos cognitio erit mathematica, secunda naturalis, tertia divina. Ratio: nam in mathematicis procedimus a causa supra effectum, et causa est magis sensata et notior quam effectus; et ideo quoad nos, etiam loquendo de vera cognitione quae habetur per causam, mathematica est notior. Secundo loco naturalis, quia non habet causas ita sensatas, licet habeat effectus sensatos. Tertio loco divina, quae neque causas neque effectus sensatos habet, et ideo quoad nos certitudine demonstrationis a priori metaphysica est ultima... Loquendo vero de cognitione quoad naturam et in se, dico quod prima est ipsa divina, quia est de perfectissimis substantiis; secundo loco vero est ipsa naturalis: est enim naturalis de substantia; et quia mathematica de entibus vilissimis, ut accidentibus, est, ideo est infima et ultima."

[36] See C. H. Lohr, "The Sixteenth-Century Transformation of the Aristotelian Natural Philosophy," in: E. Kessler, C. Lohr and W. Sparn (eds.), *Aristotelismus und Renaissance. In memoriam Charles B. Schmitt* (Wolfenbütteler Forschungen 40), Wiesbaden 1988, 89-100.

[37] See Galileo Galilei, "Tractatio de praecognitionibus et praecognitis and Tractatio de demonstratione" P III,1, eds. W. F. Edwards and W. A. Wallace, Padua 1988, 13: "mathematica... quia cum sit scientia humana, versatur circa existentia," and Wallace's commentary (W. A. Wallace, *Galileo's Logical Treatises. A Translation, with Notes and Commentary, of His Appropriated Latin Questions on Aristotle's "Posterior Analytics"*, Dordrecht 1992, 116): "*human science*: that is, a science derived from sense experience. It is also a real science and not merely a rational science like logic concerned with an *esse obiectivum*."

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[38] Aristotle, *De anima* I,1; 402a5 (t.c. 2); the Latin translation is always that of Argyropulos in: *Aristoteles Latine, interpretibus variis*,(as note 19) 209 ff.); the English translation that of J. A. Smith, in: Jonathan Barnes: *The Complete Works of Aristotle. The Revised Oxford Translation*, Princeton 1984, vol. I, 641 ff.

[39] Themistius, *Paraphrasis de anima*, interprete Hermolao Barbaro, I, Cap.1, Venice 1499, repr. Frankfurt 1978, 67: "Naturae vero atque mundi contemplatores exploratoresque quomodo esse poterimus, si nobis ignorabitur ea natura, quae fons atque initium sit omnium motuum? Fortasse et corporum omnium praesertim animalium atque plantarum?"

[40] Agostino Nifo, *Expositio subtilissima... in libros Aristotelis De anima* t.c.1, (as note 34), col. 16-7: "ecce quomodo anima est ea, de qua Aristoteles loquitur, quae est fons, et principium omnium motuum et omnium corporum et plantarum et animalium, haec autem non nisi anima mundi videtur, quare Themistii sententia cum intentione fere Theophrasti occurrit."

[41] Averroes Cordubensis, *Commentarium magnum in Aristotelis De anima libros* I,c.2, 32ff., ed. F. Stuart Crawford, Cambridge, MA 1953, 5: "Tertium vero est commune iuvamentum, et est facere acquirere confirmationem in primis principiis; quoniam ex ea acquiritur cognitio causarum primarum propositionum, et cognitio alicuius per suam causam est magis firma quam sui esse tantum."

[42] Agostino Nifo, *Expositio subtilissima necnon et collectanea commentariaque in libros Aristotelis De anima* t.c. 1, Venice 1559, col. 25: "Quomodo vero conferat ad omnes veritates, declarabamus etiam quia ipsa in reditu ideas omnium rerum quasi formas suscepit, qui ergo eam sic idaeis [*sic*] formatam intelligeret, veritates omnium rerum intelligeret."

Another question is raised by Aristotle himself. In the first part of his introduction, he determines the methodological problem to be that of how the definition of the soul might be gained and asks whether there is only one universal method by which essential definitions in all disciplines are to be arrived at, just as there is only one universal method, namely demonstration, of gaining knowledge of the properties in all disciplines, or whether one has to suppose different procedures according to the differences of the subject matters.[44] Aristotle does not explicitly answer this question, so that the commentator is challenged to develop his own answer—a challenge not to be withstood, especially at a time when in response to Ramus the problem of one sole and universal method for all sciences was being defended and widely discussed.[45]

Instead of an answer Aristotle proposes three types of method—demonstration, division and some other—which might serve as the way to definition, regardless of whether the method be one or many.[46] Averroes, assuming that the method must be one and the same for all disciplines, takes Aristotle's enumeration of possible methods as a historical reminiscence of the way in which the first two, demonstration and division, stemming from Hippocrates the mathematician and Plato respectively, are replaced by an unnamed third, which must be identified with Aristotle's *via compositionis*, the method of composition.[47] Nifo basically follows Averroes, but modifies his teaching by restoring to division the task of inventing the elements of definition and leaving to composition only that of putting them together into the form of a definition.[48] At the end of the century, Zabarella seems to have in mind only the problem of invention and decides that there is no single well-defined method, but that in a certain sense all types of scientific method are able to contribute to and are needed for the invention of definition.[49] Are we entitled to see in these three examples some kind of development, representative for the general course of the discussion on method? If so, what is its essence, and what are the reasons for and the consequences of it?

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[43] A first attempt to define such a relation is to be found in Eckhard Kessler, "Von der Psychologie zur Methodenlehre. Die Entwicklung des methodischen Wahrheitsbegriffes in der Renaissancepsychologie," in: *Zeitschrift für Philosophische Forschung* 41 (1987), 548-70.

[44] Aristotle, *De anima* I,1; 402a11-19 (t.c. 4-5)

[45] See Petrus Ramus (1515-1572), *Quod sit unica doctrinae instituendae methodus*, Paris 1557; Jacobus Carpentarius (1521-1574), *Ad Expositionem Disputationis de Methodo contra Thessalum Ossatum, Academiae Parisiensis Methodicum responsio*, Paris 1564; idem, *De Methodo quod unica non sit. Contra Thessalum Academiae Pariensis Methodicum,* Paris 1564.

[46] Aristotle, *De anima* I,1; 402a19-20 (t.c. 5).

[47] Averroes Cordubensis, *Commentarium magnum in Aristotelis De anima libros* I,c.5, 19 ff., (as note 43), 8-9: "Et cum fuerit declaratum a nobis illam viam esse, et esse unam, tunc necessarium est nobis post scire illam viam que sit: utrum demonstratio, ut dicebat Ypocras, aut divisio, ut Plato dixit, aut alia via, ut via compositionis, quam Aristoteles dedit in Posterioribus."

In the second part of his exposition, Aristotle discusses in what sense the soul can be regarded as being a unity. Is it a unity in the sense of being a whole that can be divided into its parts, or in the sense that it is a universal that can be divided into the species subsumed?[50] Aristotle's reflection seems to refer to the introduction of the Physics, where he deals with the problems of division;[51] in the commentary tradition this discussion tends to be used as the occasion to deal with the problem of universals and Platonic ideas. This tendency starts in as early a commentator as Themistius,[52] and can also be found in Averroes,[53] who is then followed by such diverse commentators as Pomponazzi[54] and Nifo[55] up to Zabarella[56] at the end of the sixteenth century. Thus the commentaries to this part of *De anima* may be said to document the various different positions regarding the question of universals and Platonic ideas in relation to the theory of science from the times of late Antiquity and the Middle Ages before Ockham up to the threshold of modern science in the sixteenth century.

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[48] Agostino Nifo, *Expositio subtilissima ... in libros Aristotelis De anima* t.c. 5 (as note 34), col. 41: "Secundo dubitatur quia 2. Poster. dicitur tam divisionem quam compositionem esse vias inveniendi definitionem. Aver. autem dicit solam compositionem. Respondet Egidius divisionem esse per accidens utilem, compositionem per se necessariam, inventio enim definitionis nonnisi compositio quaedam est ex genere et differentia, verum fieri non potest, nisi praecesserit divisio. Facilius dici potest divisionem disponere ad inventionem definitionis, compositionem autem perficere ipsam inventionem."

[49] Jacobus Zabarella, *In tres Aristotelis Libros de Anima* t.c. 5, Frankfurt 1606 (repr. Frankfurt 1966) col. 36 E-37 B: "Si quis autem quaerat, quaenam est re vera methodus et instrumentum notificans quid est, de qua hic dubitat Aristoteles, cum enim *quid est* numeretur in quaestionibus et contingat ut ignoretur, necesse est esse instrumentumn aliquod, quo notificetur, ut hic Aristoteles ipse videtur significare. Declaratum quidem est hoc a nobis fuse in libris de methodis, nunc autem omnia paucis perstringens ad duo dictam rem totam redigimus. Unum est, instrumentum quo proprie et formaliter declaratur quid est, quando est ignotum, nullum est, neque esse potest. Alterum est, remote et oblique notificatur, quid est, per omnia Logica instrumenta, ut in illis libris nostris declaravimus, nempe per demonstrationem, tum a priori, tum a posteriori, per divisionem modo aliquo et per inductionem, quae est via illa compositiva, quam Aristoteles docuit in calce secundi libri Posteriorum, et quam hic significavit, quando dixit: *Aut aliqua alia methodus*."

[50] Aristotle, *De anima* I,1; 402b1-9 (t.c.7-8).

[51] Aristotle, *Physics* I,1; 184a21-b14 (t.c. 3-5).

Finally, to give one last example from the methodological introduction to the *De anima*, I should like to refer to the end of the second part, where Aristotle maintains that just as the definition is a means to gain knowledge of the properties, the properties are necessary to achieve knowledge of the definition, so that in fact it is impossible to arrive at an appropriate definition from which to derive the properties unless one is first able to give an account of the properties *katà tèn phantasían—per imaginationem*—on the basis of imagination.[57] Averroes, eager as usual to interprete Aristotle as a consistent theory, takes this paragraph as a chance to display the theory of *regressus* and to integrate the method of psychology into the general methodological concept.[58] Many other commentators, including Jandun,[59] Nifo,[60] Pomponazzi,[61] and Zabarella,[62] do not hesitate to follow him, so that the questions and commentaries to this part of *De anima* form a history of the *regressus* theory. It might not be without interest to see whether there are differences between this version of the *regressus* and that developed in the logical commentaries und treatises.[63] Other commentators, however, like Marco Antonio Genova,[64] relying on Simplicius, whose commentary on the *De anima* was available in two Latin translations published in 1543 and 1553,[65] seem to concentrate on Aristotle's reference to *phantasia* or imagination and to interprete the passage as a theory of knowledge that forms the basis for Aristotle's theory of method and science.

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[52] Themistius, *Paraphrasis de anima*, interprete Hermolao Barbaro, I, Cap. 4, Venice 1499, repr. Frankfurt 1978, 68.

[53] Averroes Cordubensis, *Commentarium magnum in Aristotelis De anima libros* I, c.8, 21 ff., (as note 43), 12.

[54] Pietro Pomponazzi, "Quaestio de universalibus," in: idem.: *Corsi inediti dell'insegnamento Padovano*, ed. Antonino Poppi, vol. II, Padua 1970, 95-151 (the questions belong to c. 8 of the lecture course on the *De anima* of 1503/04).

[55] Agostino Nifo, *Expositio subtilissima... in libros Aristotelis De anima* (as note 34), t.c. 8, col. 51-61.

[56] Jacobus Zabarella, *In tres Aristotelis Libros de Anima* (as note 51), t.c. 8, col. 47E-53E.

[57] Aristotle, *De anima* I,1; 402b16-403a2 (t.c. 11).

There are, of course, many more points of interest in the first chapter of the *De anima*, as becomes obvious from commentaries like that of

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[58] Averroes Cordubensis, *Commentarium magnum in Aristotelis De anima libros* I, c. 11, 19 ff. (as note 43) 14-5: "Cum dubitavit a quo debet incipere dominus istius artis, utrum a posterioribus ad precedentia, aut econtrario, incepit notificare quod utraque via est communis in scientiis et in usu earum... ."

[59] Ioannes de Ianduno(† 1328), *Super libros Aristotelis De anima* I, q. 10, Venice 1587, col. 48-56.

[60] Agostino Nifo, *Expositio subtilissima... in libros Aristotelis De anima* t.c. 11 (as note 34) col. 66-79.

[61] Pietro Pomponazzi, "Utrum detur regressus" (as note 56), 153-76 (the question belongs to c. 11 of the lecture course on the *De anima* of 1504/09).

[62] Jacobus Zabarella, *In tres Aristotelis Libros de Anima* t.c. 11 (as note 51), col. 59-67.

[63] Giovanni Papuli (as note 6), 273-7 mentions only Themistius and Pomponazzi with their commentaries to the *De anima*. A first attempt regarding Pomponazzi and Nifo is made in Eckhard Kessler, "Physik oder Metaphysik. Beobachtungen zum Begriff der Naturwissenschaft in der Methodendiskussion des 16. Jahrhunderts," in: F. Domínguez, R. Imbach, T. Pindl and P. W. Steenbrugge (eds.), *Aristotelica et Lulliana, magistro doctissimo Charles H. Lohr... dedicata* (Instrumenta Patristica 26), The Hague 1995, 223-44.

[64] Marco Antonio Genova (Janua) (1491-1563), *In tres libros Aristotelis de Anima exactissimi Commentarii* I, t.c. 11, Venetiis 1576, 19va-20va; for his close relation to Simplicius in general see my "Psychology: The intellective soul," in: C. B. Schmitt, E. Kessler and Q. Skinner (eds.): *The Cambridge History of Renaissance Philosophy*, Cambridge 1988, 525-6.

[65] Simplicius, *Commentarii in libros De anima Aristotelis*, intreprete I. Faseolo, Venice 1543; *Commentaria in tres libros De anima Aristotelis* t. 11, E. Asulano interprete, Venice 1553, I use the reprint, Frankfurt 1979, of the edition Venice 1564, fol. 3rb.

Francesco Piccolomini,[66] which amounts to seventy-seven pages, but I shall stop here and say a few words about our third text, the first book of *De partibus animalium.*

4 The first book of *De partibus animalium*

Ingemar Düring argued that the first book of *De partibus animalium* was conceived by Aristotle when, after years of biological research together with Theophrastus, he opened his own school at Athens to serve as an "introduction to the new science of nature."[67] Although this tempting hypothesis has been proved to be wrong,[68] the book does seem to have been put together rather hastily. It does not bear the character of a systematic treatise, but is, to an extent unusual even for Aristotle, full of suggestions, allusions and interruptions which make it difficult to determine the intended course of the argument.

Traditionally divided into five chapters, the book has been subject to various attempts to structure the disorganisation of the text. Averroes complains about the difficulty and confusion of the book,[69] and gives only a paraphrase of it. With the exception of the introductory passage and the final fifth chapter, he summarizes the whole body of the argument in three questions: 1. How many are the causes required in this science? 2. How is necessity to be found in natural beings? 3. What is the way of enumeration of subjects in this science and what is the method of the order of doctrine in it?[70] Theodorus Gaza's Latin translation, included in the

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[66] Francesco Piccolomini (1523-1607), "In tres libros Aristotelis de Anima," in: *Commentarii duo: Prior, In libros Aristotelis de Ortu et Interitu: alter, In tres libros eiusdem, de Anima*, Frankfurt 1602. The commentary to *De anima* I,1 on 385-462.

[67] See I. Düring, *Aristotle's De partibus animalium. Critical and Litarary Commentaries*, Göteborg 1943, 34-5.

[68] See Ueberweg (as note 1), vol. 3, 270.

[69] Averroes, "Paraphrasis in Aristotelis De partibus animalium," in: *Aristotelis Opera cum Averrois commentariis*, Venice 1562-74 (repr. Frankfurt 1962) vol. VI, 127 B: "Adde et quod verba Aristotelis habent magnam difficultatem atque confusionem in hoc libro."

[70] See Averroes, *Paraphrasis in Aristotelis De partibus animalium* (as note 71), 120 D-E: "Quicquid autem de hoc in isto libro dicetur, id tria amplectetur quaesita (praehabito tamen prooemio). Primum est quot sunt causae requisitae in ipsa et qualiter ad se invicem referantur? Secundum quaesitum est, quo pacto reperitur

Junta edition of Aristotle's Opera with Averroes' commentaries from 1562, assigns a title to each of the five chapters, attributing Averroes' introductory passage and first two questions to the first chapter, giving chapters two to four titles referring to the method of division, and treating chapter five as dealing with the subject of this science.[71]

Of the modern interpreters, Düring tries to follow the traditional division into chapters, subsuming the first chapter under the title "On the method of natural science" (639a1-642b4), putting chapters two and three together as "Criticism of the Platonic-Speusippean method of dichotomy and classification" (642b5-644a11), calling the fourth chapter "The true method of classification" (644a12-b21) and splitting the fifth into two parts: "A programme for research and instruction in the peripatetic school" (644b22-645a36) and "A survey of the following course of lectures" (645b1-646a4).[72] Louis in his bilingual Greek-French edition breaks the whole argument into sixteen sections, thus giving an indication of the wide variety of topics which are touched upon in the course of Aristotle's argument.[73]

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necessitas in rebus naturalibus et qualiter ad eas referatur. Tertium quaesitum est, quae nam sit via enumerandis subiectis huius scientiae et qualis sit modus ordinis doctrinae, quae in ipsa fit."

[71] See Aristotle, "De partibus animalium liber primus, Theodoro Gaza interprete," in: *Aristotelis Opera cum Averrois commentariis*, Venice 1562-74 (repr. Frankfurt 1962) vol. VI, 117-127; 117B: "Cap. 1: Duos esse contemplandi et docendi praecipue habitus. De causis naturalium rerum: Et quae necessitas in eis reperitur. de quibus multa adversus Antiquos;" 121K: "Cap. 2: Contra eos, qui genus singulare in duas dividunt differentias;" 122A: "Cap. 3: Contra eos, qui differentias per privationes dividunt. Et quomodo fieri divisio debeat;" 123D: "Cap. 4: De genere et specie;" 125G: "Cap. 5: De substantiis naturalibus, partim mortalibus, partim immortalibus: et de quibus tractandum est."

[72] See Düring (as note 69), 36.

[73] Aristote, *Le parties des animaux*, gr./fr. ed. P. Louis, Paris 1956, Ch. 1: 639a1-b10: Généralités sur la méthode en biologie; 639b11-640a9: Finalité et necessité; 640a10-641a14: Forme et Matière; 641a14-b10: Le principe vital; 641b10-642a1: L'ordre de l'univers; 642a1-a13: Rôle de la necessité; 642a13-b4: Il ne faut pas négliger la forme ni la fine. Ch. 2: 642b5-b20: Critique de la dichotomie: ses insufficances. Ch. 3: 642b21-643a16: Difficultés que soulève la dichotomie; 643a16-b8: Erreurs aux quelles conduit l'emploi de la dichotomie; 643b9-644a11: Condamnation définitive de la dichotomie. Ch. 4: 644a12-b1: Principes d'une classification rationelle; 644b1-b21: Résumé sur la méthode à suivre. Ch. 5: 644b22-645a23: Intérét de la biologie; 645a23-b22: Rappel de la méthode à suivre; 645b22-646a4: Définition de quelques termes.

These different attempts to cope with the structure of Aristotle's argument may give a true impression of the diversity of topics discussed, but they do not seem really to overcome the inconsistencies of this text or to allow for a systematic understanding. This problem must have been present for Renaissance Aristotelians as well and may have been a further reason, in addition to the fact that this work was not included in the course in natural philosophy, why school philosophers who were concerned with a systematic exposition of philosophy were not drawn to comment on the *De partibus animalium.* To the best of my knowledge, by the end of the sixteenth century only six printed commentaries were in existence. Of these, three originated from before the Renaissance: the commentary of the Greek Michael Ephesius,[74] the *paraphrasis* of the Arab Averroes,[75] and the questions of the Latin Albert the Great.[76] The other three had sixteenth-century authors: the neoplatonizing Agostino Nifo,[77] who tried to comment on the whole of Aristotle's works, the humanist Nicolaus Leonicus Thomaeus,[78] who had taught Aristotle at Padua according to the Greek text, and the Cretan Daniel Furlanus,[79] whose only other book seems to have been a commentary on Theophrastus and the pseudo-aristotelian *De spiritu innato.* Obviously all three Renaissance commentators on the *De partibus animalium* were for different reasons outsiders in the context of the well-organized and institutionalized school philosophy of the sixteenth century.

It may follow from all this that the status of this work in the Aristotelian traditon was at the very least difficult, and that it was not regarded a true addition or alternative to Aristotle's systematic teaching on method in the *Organon*. This would explain why philosophers of the school used the first book of *De partibus animalium* as a treasury of arguments that seemed to fit into various other contexts rather than as a subject of systematic commentary. For the same reason this text may have been 'uncontaminated' enough to be read and accepted outside the context of school philosophy and thus to influence on philosophers and positions which we generally regard as anti-Aristotelian. For the purposes of this paper, I should like to point to a few examples of both these ways of reception.

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[74] Michael Ephesius, *Scholia in IV libros Aristotelis De partibus animalium*, interprete D. Montesauro, Florence 1548; see Lohr (as note 10), 271.

[75] Averroes, *Paraphrasis in Aristotelis De partibus animalium* (as note 71) 120r-127r.

[76] Albertus Magnus, *Quaestiones super de animalibus*, Lib. XI (Aristoteles, De partibus animalium L.I), ed. E. Filthaut O.P., in: *Opera omnia*, t. XII, Münster 1955, 218-24.

[77] Agostino Nifo, *Expositiones in omnes Aristotelis libros De historia animalium / De partibus animalium / De generatione animalium*, Venice 1546; see Lohr (as note 10), 282 ff.

[78] Nicolaus Leonicus Thomaeus (1456-1531), *Conversio in latinum atque explanatio primi libri Aristotelis De partibus animalium*, Venice 1540; see Lohr (as note 10) 452-3.

[79] Daniel Furlanus († 1600), *In libros Aristotelis De partibus animalium commentarius primus*, Venice 1574; see Lohr (as note 10), 155.

There are at least two treatises which document the selective use of the text made by the philosophers of the school. The first is that of Archangelus Mercenarius,[80] who uses Aristotle's statement that only parts of the soul, and not the soul in its totality, are the subject of the natural philosopher as an argument in the discussion on the immortality of the soul.[81] The second is that by Cesare Cremonini, who in *De paedia*, an introductory treatise to his commentary on the *Physics*, refers to Aristotle's remarks in the beginning of the *De partibus* on the role of *paideía* and *epistéme* in the sciences.[82] Although Cremonini complains that virtually none of his contemporaries is interested in *paedia*,[83] his treatise is in fact obviously the result of an on-going discussion on the concept of *paedia*, which seems at the end of the century to give rise to some interesting results. We find, on the one hand, a tradition which translates *paideía* with *eruditio*, erudition, and understands it to be the knowledge of its appropriate methods and general principles, which is previous to and necessary for a science. This is the interpretation offered by both Michael Ephesius[84] and Averroes.[85] This tradition seems increasingly to reduce *paideía* to mere methodological knowledge, as in the commentaries of Nifo[86] and Furlanus,[87] and to lead ultimately to the distinction of logic in general into the common or universal logic of the *Organon*, which deals with the methodological instruments common to all disciplines and sciences, and into the particular or specific logics of the introductions to the *Physics*, the *De anima* and the *De partibus animalium*, which deal with the specific methods and principles of the different sciences. This final development is found in the thought of, for instance, Zabarella,[88] Pacius,[89] and Pázmány.[90] According to this tradition, the

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[80] Archangelus Mercenarius († 1585), *Judicium super rationibus Aristotelis De partibus animalium cap. I*, Padova 1570; see Lohr (as note 10), 260-1.

[81] See Aristotle, *De partibus animalium* I,1; 641a32-b10

[82] Cesare Cremonini (1550-1631), "Tractatus de paedia," in: *Explanatio prooemii librorum Aristotelis De physico auditu, cum introductione ad naturalem Aristotelis philosophiam, continente tractatum de paedia*, Padua 1596; see Lohr (as note 10), 109 ff.

[83] Cesare Cremonini (as note 84), [4]v: "Primum est de Paedia, re... ab omnibus propemodum, qui hodie ad philosophandum accedunt, tam multum ignorata tamque levi studio quaesita."

[84] Michael Ephesius, *Scholia in IV libros Aristotelis De partibus animalium*, interprete D. Montesauro, Florence 1548; Basel 1559, fol. 8-9: "*eruditus* ille

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vocatur, quemadmodum in geometria, non qui exquisitam geometricorum omnium theorematum habitum obtinet, quum talis sciens proprie nominetur, sed qui geometrica principia et nonnullorum geometricorum theorematum et cognitionem possidet quique ex his iudicare potest id, quod disputatione discutitur, ut geometrae iuxta geometrica principia et ut geometre disserere opus est."

[85] Averroes, "Paraphrasis in Aristotelis de partibus animalium," in: *Aristotelis Opera cum Averrois commentariis*, Venice 1562-74, repr. Frankfurt 1962, vol.VI, 120F: "Dicamus ergo quod cum quaelibet ars contemplativa habeat duplicem modum notitiae, unum scilicet rerum requisitarum in ea arte, alterum vero canonum et semitae propriae secundum quam speculatur professor illius scientiae: ut si quid recte in illa arte dictum sit, id verum esse iudicet, si vero aliquod falsum, id quoque non rectum esse: oportetque ut, si quis aliquam artem contemplari incoeperit, ipse sit compos huius certe virtutis, antequam illam speculetur artem. Et ideo oportet ut quaelibet ars habeat certas definitiones et causas determinatas, certa subiecta nonullasque regulas."

[86] Agostino Nifo, *Expositiones in... De partibus animalium...* (as note 79) fol. 1: "In omni contemplatione videntur duo modi habitus, alter qui scientia, alter qui paedia, hoc est eruditio dicitur. est autem eruditio cognitio modi tradendi scientiam, scientia vero cognitio de veritate rerum, quae traduntur". Nifo refers to Averroes and Ephesius and argues against Albertus Magnus.

[87] Daniel Furlanus, *In libros Aristotelis De partibus animalium...* (as note 81), 28: "alteram, quae *paideía* dicitur, alteram, quae vocatur *epistéme*, hanc scientiam dicimus, illam alii peritiam, non desunt, qui etiam experimentum, nos eruditionem apellabimus... ." See also 29: "quoniam artes atque scientiae aliae subiecta materia et tractationis ratione differunt, aliae materia quidem conveniunt, tractatione discrepant, esse methodum oportet et habitum, quo quae susceptae scientiae propria sunt declarantur, quomodo quave ratione quousque etiam pertractandae sint... ita in omnibus tenenda est via et ratio, qua singula pertractare oporteat. haec *paideía* dicitur, hoc est eruditio," and 40: "eruditum ea nosse oportere, de quibus iudicat... novit autem non omnia, sed principia et Theoremata quedam, quae cum habeat facile iudicat de iis, quae in scientia sunt."

[88] Jacopo Zabarella, *De natura logicae* II,1, in: *Opera Logica*, Cologne 1597, repr. Hildesheim 1966, 53A-B: "Illud in primis inter omnes constat, quod ab Averroe declaratur in sua praefatione in primum lib. Posteriorum, totam logicam in duas praecipuas partes secari; quarum unam vocat Averroes universalem seu

"second look" at method in the Aristotelian tradition would deal exactly with the *paedia*.

On the other hand, there seems also to be a tradition, beginning with the humanist Leonicus Thomaeus,[91] in which *paideía* is translated with

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communem, alteram particularem sive propriam. Pars communis tribus libris absolvitur, libro Categoriarum, de Interpretatione, et Priorum Analyticorum. Pars autem propria continet posteriores Analyticos et alios omnes sequentes."
See also Averroes, "Commentarium Magnum in Aristotelis Posteriorum Analyticorum librum primum" Prooemium, in: *Aristotelis Opera cum Averrois commentariis*, Venice 1562-74, repr. Frankfurt 1962, vol. I, 2, a, 3D: "At dum de his duobus in hoc libro pertractat, nempe de demonstrationibus et de definitionibus, eius quidem pertractatio non pervenit, seu desinit in pertractationem de ultimis differentiis uniuscuiusque artis. Cum quod proprium est unicuique arti, consuevit ipse facere de eo mentionem in illamet arte, ut in libro Physicorum et in 1º de Partibus Animalium manifeste videri potest." Obviously Zabarella differs from Averroes about where the dividing line between the two parts of logic should be placed.

[89] Julius Pacius (1550-1635), "In Porphyrii Isagogen Commentarius Analyticus," in: *In Porphyrii Isagogen et Aristotelis Organum Commentarius Analyticus*, Frankfurt 1597, 2b: "Tertio ab Averroe dividitur in logicam communem et appropriatam, seu particularem. Communem logicam Averroes vocat artem ipsam generalem, quae est omnium aliarum artium et scientiarum instrumentum: cuiusmodi logica est, quae in Organo ab Aristotele traditur. Appropriatam seu particularem appellat eam, quae cuiusque scientiae propria est et ab Aristotele dicitur esse *hôs paideía tis*, quasi eruditio quaedam, de partibus animalium lib.I, cap.1 [639a4]; vocatur etiam *trópos tês epistémes*, modus scientiae seu modus sciendi, Metaphysicorum lib. I minore, cap. ult. [995a14], qua cognitione qui est ornatus, dicitur esse *pepaideuménos*, eruditus, Ethicorum lib. I, cap. 3 [1094b23]. Talis in Physica est tractatus de subiecto, methodo ac demonstrationibus physicis, et in logica hic, qui nunc est a nobis de ipsa logica institutus, quid significet, quid sit, quas habeat partes et utrum sit philosophiae pars an instrumentum. huic opponitur *he tôu prágmatos epistéme*, ipsius rei scientia: ut in physica cognitio corporum naturalium et affectionum quae in iis corporibus insunt, et in logica cognitio enunciationis et syllogismi." See Lohr (as note 10), 296-7.

[90] Petri Cardinalis Pázmány (1570-1637), *Dialectica*: *De natura dialecticae* q.5, ed. St. Bognár, Budapest 1894, 51-2: "Prima ergo divisio est, in *universalem* et *particularem*, quam recentiores ex Aristotele 1. de Partibus animalium c. 1 desumi aiunt, eamque sic explicant, ut per Logicam universalem velint intelligi illam, quae tradit communia, omnibus scientiis deservientia praecepta... particularem vero esse illam, quae tradit modum determinatum, et praecepta quaedam particularia, alicui scientiae propria... et huiusmodi particulares Logicas, aiunt, tot esse inter se divisas, quot sunt scientiae totales. Ratio est: quia diversitas scientiarum et modorum sciendi, pendet ex diversitate scibilium: ergo si sint diversa scibilia, et modi particulares illa sciendi diversa erunt". See C. H. Lohr (as note 10), 304-5.

[91] Nicolaus Leonicus Thomaeus, *Conversio in latinum atque explanatio...* (as note 80), 8: [duos sunt] "habitus sive modi, quorum alter rei ipsius vera est scientia,

peritia (experience) and defined as a rather universal and confused knowledge. Thomaeus ends with the hypothesis that natural science is not science proper but *peritia* in the sense of *paideia.* Here he is clearly using Aristotle's distinction between *epistéme* and *paideía* to develop a specific concept of natural science. At the end of the century, Cesare Cremonini seems to follow Thomaeus, for although Cremonini does not deny that *paideía* requires some, if only natural, logical faculty, for him the main focus of *paideía*, at least within natural science, is experience.[92] For this Aristotelian the notion of *paideía* serves as a call for more experience in the science of nature.

Both these traditions seem to be closely connected in the work of the Paduan Francesco Piccolomini. In his exposition of the *Nicomachean Ethics*, Piccolomini discusses *paideia* as one of the mental virtues (*virtutes mentis*) and explicitly defends a concept of it which combines both interpretations, so that both specific methodological knowledge and particular empirical knowledge are seen as precognitions, and required for whoever wants to enter the field of a discipline.[93] The impact of the

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cum ex ipsis veris et immediatis procedat causis universam eius essentiam continentibus et declarantibus. Alter vero universalior confusiorque rei illius est cognitio et ex remotioribus materialioribusve emanans causis, a re tamen illa non alienis, per quem peritus et eruditus quisque iure appellari potest et debet, non tamen vere sciens, cum nihilominus de re illa iudicare et suam ferre sententiam eleganter et apte possit... 11: Ex quibus etiam cuivis patere potest, naturalem scientiam non proprie scientiam appellari debere... sed peritiam potius et eruditionem."

[92] Cesare Cremonini (as note 84), fol. 3v: "Pedia est facultas recte iudicandi circa modum docendi et discendi ex Logica ortum ducens cum opportuno experientie interventu... ." See also fol. 4v: Logicae autem vocabulum sumo prout est amplum ad utramque: Logicam naturalem scilicet et artificiosam, est enim Logica tam naturalis quam artificiosa...Adiungo interventum experientie, quia, quamvis aliquis aut ingenio aut Logica sit instructus, nisi sit etiam expertus in eo ipso, circa quod est iudicandum, non poterit id iudicium ferre. Dico opportuno, idest accomodato, quia non idem modus experientiae ubique reperitur, sed in Math. satis est pro principiis confirmandis observatio Inductioni derserviens, quae fit in materialibus, unde mathematica abstrahuntur, inde autem statim principiorum veritas innotescit; In naturalibus vero, primo quidem talis observatio, pro principiis habendis, non est ita obvia, nec ab ipsis principiorum collectio est ita facilis, verum requiritur negotiosa animadversio ex applicatione ad res studio comparata perque ipsam principia non sine acri cogitatione accipiuntur, deinde non est solum haec experientia naturali necessaria, pro primis principiis comparandis, sed per totam propemodum scientiam est requisita."

[93] See Francesco Piccolomini, *Universa philosophia de moribus* V, 13, Venetiis 1583, fol. 254C-D: "Est igitur paedia commune nomen, universe denotans

question of *paideia* on the discussion of method and, in particular, on the epistemological discussion of the late Renaissance seems to deserve further investigation.

In the following passages of the first chapter, Aristotle defines certain questions, the answers to which serve as the subject matter of the *paideía tês perì physin historías*, the precognition required for the investigation of nature or natural science. Although these questions are not without interest, I shall not enumerate them all, but mention only two examples which may show their relevance to the sixteenth century discussion on method.

Aristotle's second question asks whether the *physikós*, the student of nature, should follow the method of mathematical astronomy, that is, whether he should consider first the phenomena in the world of animals and assign their causes later, or whether he should follow some other procedure.[94] Given the significance of the difference between natural science and mathematics[95] as well as their combination in the "mixed sciences"[96] in the Aristotelian tradition, and the importance attributed by Pierre Duhem to the procedure of "saving the phenomena" in the history of science,[97] the methodological identification of the physicist and the mathematical astronomer suggested here is startling and worth further investigation. A superficial reading of the commentaries gives the

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omnem rectam institutionem, cum ad disciplinas, tum ad omne genus vite, quod recte ducere optamus... Quam rectam institutionem non ex uno tantum, sed ex variis ortum ducere conspicuum est. Oritur enim nonnumquam ex congruente educatione, familiari adhortatione, rectaque assuetudine... Insuper oriri potest ex experientia, exercitatione et usu rerum... Similiter naturalis Philosophia experientiam expostulat et paedia ad eam frequenter experientia acquiritur... Insuper oritur paedia ex Logica; nam Logica facit nos discipulos, hoc est nos recte parat, variisque modis aptos reddit ad ceteras disciplinas... Ex his constat, quod ceteri, qui paediam contrahunt vel ad experientiam, vel ad Logicam, vel ad notitiam ex remotis causis, diminute eam explicant ac pro toto partem accipiunt."

[94] Aristotle, *De partibus animalium* I,1; 639b5-10.

[95] See Aristotle, *Physics* II,2; 193b22-194b15.

[96] See e.g. W. R. Laird, "The Scientiae Mediae in Medieval Commentaries on Aristotle's Posterior Analytics," Ph.D. thesis, Univ. of Toronto 1983, and his article in this volume.

[97] Pierre Duhem, *Sozein ta phainomena. Essai sur la notion de théorie physique de Platon à Galilée*, Paris 1908 (Engl.: *To save the phenomena*, Chicago 1969); see also N. Jardine, "Epistomology of the sciences: The Status of Astronomical Hypotheses," in: Schmitt et al (as note 66), 697-702.

impression that while Ephesius,[98] Thomaeus,[99] and Nifo[100] seem to view this recommendation to start with the phenomena simply as a confirmation of the *a posteriori* character of natural science, Furlanus understands it as referring to the whole discussion about the relation between natural and mathematical sciences and uses Aristotle's text to identify mathematical astronomy and natural science.[101]

One of Aristotle's arguments in answer to this question concerns the kind of necessity that can be found in nature. In contrast to the world of eternal beings, in which absolute necessity reigns, the sublunar world of transitory beings knows only *anánke ex hypothéseos*, hypothetical or supposed necessity. Since, therefore, a cause does not necessarily produce its effect, this seems to mean that in natural science it is only possible to argue from the existence of the effect—or the final end—to its causes, but not from the existence of a cause to its effect.[102] There are several problems involved in Aristotle's argument which I do not want to discuss in detail here. These include the question of the relation between natural science and the arts, which has been discussed by the commentators and resolved with great elegance by Ingemar Düring,[103] and the problem of the role of teleology in the emergence of modern science. There is, however, one problem which I should like to mention: how and with what consequences was the "hypothetical necessity" of the world of nature understood in the sixteenth century?

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[98] Michael Ephesius (as note 86), 11-2.

[99] Nicolaus Leonicus Thomaeus (as note 80), 17: "Utrum s. in illis procedere debeamus ut ab effectu nobis cognito sensuque percepto ad illius investigandas reddendasque causas, an alia quadam via quam ea, qua, ut dictum est, mathematici consuevere."

[100] Agostino Nifo, (as note 79), fol. 3b: "Astrologos qui theoretice de stellis disserunt, primum supponere apparentias effectusque ipsos, qui stellis inesse videntur ut eclipses... post investigare enituntur causas, ex quibus possint stellis assignare huiusmodi apparentias."

[101] Daniel Furlanus (as note 81), 63-4: "fit enim nescio quomodo, ut eadem fere Astrologus atque physicus contemplentur."

[102] Aristotle, *De partibus animalium* I,1; 639b21-640a10. See also 642a1-a18.

[103] See I. Düring, "Aristotle's method in biology," in: S. Mansion (ed.), *Aristote e les problèmes de méthode. Communication présentées au Symposium Aristotelicum à Louvain du 24 août au 1 septembre 1960*, Louvain/Paris 1961, 213-21. For the discussion of the problem in the commentaries see Furlanus (as note 81), 89; Nifo (as note 79), 4b-5b.

Of the three Renaissance commentators Nifo obviously realises that, since hypothetical necessity is meant to be an ontological quality of sublunar nature, in natural science the argument from the effect to the causes is no longer due to the limited intellectual capacities of man, but results from the ontological status of nature itself, so that the reverse way of reasoning from the causes to the effects, which is needed for the *regressus*, is impossible for ontological reasons.[104] Consequently he is keen to find arguments that would save the *regressus* for natural science.[105] Furlanus, on the other hand, does not hesitate to admit that in natural science there is indeed no way to argue from the cause to the effect.[106] Finally Thomaeus on the one hand allows for the *regressus* only in the contemplative disciplines such as mathematics and theology,[107] but on the other identifies the effect or final cause with the formal cause, and, to a certain extent, with the efficient cause as well,[108] revalues this super-cause as the primary cause in terms at least of dignity and excellence if not of time,[109] and recalls that it thus represents exactly what is meant by

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[104] Agostino Nifo (as note 79), fol. 5b: "in aeternis conversio fieri potest, in naturalibus et artificiosis fieri non potest... in generabilibus dici quidem potest, si homo futurus est, praecedere semen genitale necesse est, sed non e converso, si semen praecessit, hominem fore necesse est."

[105] Agostino Nifo (as note 79), fol. 5b: "in naturalibus respectu aliquorum conditionalis necessitas videtur reciproca. quoniam dicere possumus, si mors animalis futura est, animal vivat necesse est, et econverso, si animal vivit, mortem in animali futuram esse necesse est."

[106] Daniel Furlanus (as note 81), 94: "in physica nunquam dicimus, est semen, erit igitur et homo."

[107] Nicolaus Leonicus Thomaeus (as note 80), 29: "...quod fit autem illud est, quod veram non habet permanentiam, sed semper fit, et nunquam vere est, quod certe multis intercedentibus causis praepediri potest ut ad constitutum non perveniat finem. Quamobrem in omnibus iis posito quidem fine, ea quae ad illum faciunt poni necesse est. Non autem illis positis et praecurrentibus, ut retro etiam diximus, necessario iis consequitur finis... Secus autem in contemplativis disciplinis isthaec se habet res, effectus et causae ad seinvicem necessario convertuntur, et in sese invicem recurrunt, nullaque quominus id eveniat intercedere possunt obstacula."

[108] Nicolaus Leonicus Thomaeus (as note 80), 20-1: "Verum finem et formam in idem concurrere voluerunt, ratione potius has causas, quam re ipsa distare... Ceterum efficiens etiam causa, ut Philopono placuit in commentariis super secundo de physico auditu (as note 23, fol. 46rb), cum fine et forma aliquando concurrere videtur."

[109] Nicolaus Leonicus Thomaeus (as note 80), 23: "Nam primus tempore locus, sic considerantibus, sine controversia materiae est assignandus... Dignatione autem et

propter quid.[110] In this way the *regressus* loses its magic appeal and the procedures of natural science, which argue from the final to the material and efficient causes, become a self-sufficient and independent scientific method.

Before I close with some remarks on the possible reception of the *De partibus animalium* outside the school, I should like to indicate a final topic that seems pertinent to the discussions on method in the sixteenth century, that is Aristotle's discussion and critique of the Platonic-Speusippean method of dichotomic division in chapters 2 to 4.[111] Thanks not only to the *Posterior Analytics* but also, as we have seen, to the *Physics* and the *De anima*, division was already present in the Aristotelian tradition, even without the growing influence of Neoplatonism. When, in the second half of the sixteenth century, Petrus Ramus rudely interrupted the relatively peaceful discussion on method with the proclamation of his universal method of *systema* or *collocatio*, based, according at least to his companion and follower Audomarus Talaeus,[112] on dichotomic division, the relevant chapters of Aristotle must have gained in importance and interest to opponents of Ramus such as Carpentarius[113] or Schegk,[114] and consequently also for the defenders of Ramism.

With Ramus and Ramism we arrive at the limit of Aristotelian school philosophy. As we shall see, this is not identical with the limit of the impact of the Aristotelian tradition on the methodological development in the philosophy of nature. We are used to considering the first book of the *De partibus animalium* as Aristotle's contribution to the method of biology, and nobody doubts that this is the case. Yet in the course of his

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excellentia omnium sane prima finalis est causa, propter illam enim omnia agunt quaecunque agunt et ad illam extremam finem referuntur omnia."

[110] Nicolaus Leonicus Thomaeus (as note 80), 20 -1: "... et quoniam quod appetitur et desideratur, semper aut bonum est, aut certe apparens, de quacunque re interroganti propter quid, semper finem adducere solemus."

[111] Aristotle, *De partibus animalium*, I, 2-4; 642b5-644b21.

[112] See Petrus Ramus (1515-72), *Dialectica Audomari Talaei Praelectionibus illustrata*, Basel 1572, 205; see also n. 47 above. For Ramus in general see W. Schmidt-Biggemann, *Topica universalis. Eine Modellgeschichte humanistischer und barocker Wissenschaft*, Hamburg 1983, 31-66.

[113] See n. 47 above, and also Lohr (as note 10), 78.

[114] For a bibliography of the polemics between Petrus Ramus and Jacobus Schegk see Lohr (as note 10), 410; it might be interesting to compare also Schegk's teaching on division in his methodological writings.

argument Aristotle often speaks rather generally, postulating a *paideía* for the investigator of nature as such,[115] raising general questions about the *physikós* or natural scientist,[116] about natural coming to be,[117] and about the ontological status of natural beings,[118] and criticizing the Presocratics for their unacceptable method in natural philosophy and cosmology.[119] Thus it does not seem to be totally mistaken to understand at least the first chapter of this book as a general treatise "On the method of natural science" which uses biological phenomena only as a storehouse from which appropriate examples can be supplied.[120] Indeed, when Aristotle finally defines the soul as being the moving as well as the final cause[121] and seems to suggest that the soul is identical with nature itself,[122] a reader who has some affinity with the Neoplatonic teaching of the *anima mundi*, the world soul, and is inclined to see the world from the animistic point of view might well suppose that Aristotle's biological method could serve as the appropriate general method of natural science in the context of an animistic universe.

That this was indeed the case and that the first book of the *De partibus animalium* was used by alternative philosophers of nature as a source for an alternative method in natural philosophy, has, as far as I know, not yet been proved. There does, however, seem to be strong internal evidence that, at least in some cases, some such relationship exists which it would be worth pursuing further. The cases I have in mind are those of Girolamo Cardano and Bernardino Telesio.

It is well known that Girolamo Cardano, despite his explicit polemic against Aristotle, owes much in his philosophy of nature to Aristotle and the Aristotelian tradition.[123] The foundations of his natural philosophy, the animistic character of the universe and the specific organic structure of all natural unity, seem to be derived from Neoplatonic and Galenic rather than Aristotelian sources. However, when Cardano argues in his treatise *De natura* against the distinction between nature and soul in Aristotle on the grounds that there is no valid reason for the assumption of two rather than one principle of natural beings, even in Aristotle, and concludes that this one principle must be the soul, so that the name of the natural scientist should be *qui de anima tractat*, "he who treats about the soul," rather than *physicus*,[124] he seems simply to be drawing the consequences of the nearly identical use that Aristotle makes of *anima* and *natura* in the *De partibus animalium*.[125] Moreover, when in his *Liber de uno* Cardano describes the universe as an organic unity organized by the soul as the moving as well as final cause, the parts of which are subordinated organic unities which can be known from their instrumental function[126] he seems to be developing exactly the concept of the soul as the moving and final principle of a teleologically structured nature that is outlined in Aristotle's method of biology.[127]

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[115] See Aristotle, *De partibus animalium* I,1; 639a12.

[116] Ibid., 639b5.

[117] Ibid., 639b11;b30; 640a10 ff.

[118] Ibid., 639b21.

[119] See Ibid., 640b4 ff.; especially b11.

[120] As does Düring (as note 69), 36.

[121] See Aristotle, *De partibus animalium* I,1; 641a15.

[122] Ibid., 641b9;b12; 642a17.

[123] See M. L. Bianchi, "Scholastische Motive im ersten und zweiten Buch des *De subtilitate* Girolamo Cardanos," in: E. Kessler (ed.), *Girolamo Cardano. Philosoph, Naturforscher, Arzt* (Wolfenbütteler Abhandlungen zur Renais-

My second case of a natural philosopher from outside the school who seems to have profited from the *De partibus animalium* is Bernardino Telesio, also known for his ambivalent relation to Aristotle whom he

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sanceforschung Bd. 15), Wiesbaden 1994, 115-30; E. Kessler, "Alles ist eins wie der Mensch und das Pferd. Zu Cardanos Naturbegriff," in: ibid., 91-114.

[124] Girolamo Cardano (1501-76), "De natura," in: *Opera omnia*, Lyon 1662, repr. New York/London 1967, vol. II, 283-98, esp. 285bff.

[125] Aristotle, *De partibus animalium* I,1; 641a14 -b10.

[126] Cardano, "Liber de uno," in: *Opera omnia*, Lyon 1662, repr. New York/London 1967, vol. I, 277-283, especially 278b-279b; 279b20ff.: "Quaecumque igitur in mundo sunt, unius mundi causa sunt et operationum illius: quemadmodum et in homine, praeter ea quae corrupta sunt: sunt enim veluti ascarides in hominibus: at in mundo cum omnia contineat, nihil est alterius causa ut in homine. Nescimus autem hoc in mundo: quia operationes illius universas non cognoscimus, et quemadmodum in unum ordinantur, velut in homine, qui ergo principales mundi operationes et ordinem earum intelligeret, et universas partes quorum causa factae essent?"

[127] Aristotle, *De partibus animalium* I,1; 640a10-642a31; 642a11-13: (Gaza's translation in Averroes, *Paraphrasis in Aristotelis De partibus animalium* (as note 71), 119L-M: "cum instrumentum sit corpus (est enim tum membrum unumquodque rei alicuius gratia, tum vero totum ipsum) efficitur profecto, ut esse tale atque ex talibus constare necesse sit, si illud, cuius gratia ipsum est, futurum sit."

criticizes and uses simultaneously.[128] With the exception of some small, preparatory treatises,[129] Telesio's only philosophical work was *De rerum natura iuxta propria principia*,[130] the result of life long study. Here he develops a new concept of the structure of the universe, applying an empirical method of research which he claims to be the first to follow; this method is, he says, exclusively empirical. He has been criticized since the times of his younger contemporary Francesco Patrizi for the obvious falsity of this latter assertion.[131] Yet, in the light of *De partibus animalium* it seems evident that Telesio's approach is neither that of a crude, unreflected empiricism nor unheard of in the history of philosophy. His claim to start exclusively with the observable phenomena of nature instead of their fictitious causes[132] proves to be nothing but Aristotle's suggestion that natural science should follow the astronomer's method of saving the phenomena,[133] while his demand that the true philosopher of nature should explain why the universe had to be constructed in the way it is constructed rather than how the universe was constructed[134] (a demand which seems to have been totally neglected by modern Telesio scholars) is strikingly similar to Aristotle's argument that natural phenomena should be explained in terms of the final cause instead in terms of the effective cause, as had been characteristic for Presocratic cosmogony.[135] Even the puzzle which has perplexed all Telesio scholars, namely that Telesio, in spite of his radical naturalistic attitude, supposes two souls—the general soul, specific for nature and common to all natural beings including the human ones and an additional, supernatural and immortal soul, found only in human beings[136]—seems to find its solution in Aristotle's teaching that the soul is not entirely natural and therefore not entirely the subject matter of natural science.[137]

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[128] See M.-P. Lerner, "Aristote «oublieux de lui-mêmes» selon B. Telesio," in: *Les Etudes Philosophiques* 1986, Nr. 3, 371-89.

[129] Bernardino Telesio (1509-88), *Varii de naturalibus rebus libelli*, ed. L. De Franco, Florence 1981.

[130] Bernardino Telesio, *De rerum natura iuxta propria principia*, Lt./It., ed. L. De Franco, vol. I, Cosenza 1965; vol. II, Cosenza 1974; vol. III, Florence 1976.

[131] See Francesco Patrizi (1529-97), "Letter to Bernardino Telesio," in: B. Telesio, *Varii de naturalibus rebus libelli*, ed. L. De Franco, Florence 1981, 463 ff.

[132] Bernardino Telesio, *De rerum natura iuxta propria principia* (as note 132), I, Prooemium, vol. I, 26ff.: "Qui ante nos mundi huius constructionem rerumque in eo contentarum naturam perscrutati sunt... mundi ipsius principia et caussas ratione inquirere ausi, et, quae non invenerant, inventa ea sibi esse existimantes volentesque, veluti suo arbitratu mundum effinxere... Nos... mundum ipsum et singulas eius partes, et partium rerumque in eo contentarum passiones, actiones, operationes et species intueri proposuimus. Illae enim, recte perspectae, propriam singulae magnitudinem, hae vero ingenium, viresque et naturam manifestabunt."

[133] Aristotle, *De partibus animalium* I,1; 639b5-640a10.

[134] Bernardino Telesio, *De rerum natura iuxta propria principia* (as note 132), I, 9-10, vol. I, 88-103; see the titles of the chapters; ch. 9 (88): "Non modum, quo, qualis est, constructus sit mundus, sed cur ita construendus fuerit et cur, quibus caelum movetur, motibus iis moveri oportuerit inquirendum esse;" ch. 10 (94): "Cur mundus, quomodo constructus est, construendus fuerit, iique caelestibus orbibus dati sint motus, quibus moveri apparent."

5 Conclusion

From this we can see that there is a close affinity between the "new" philosophy of nature found in Cardano or Telesio and Aristotle's thought in the *De partibus animalium*, even if their dependance upon Aristotle still remains to be investigated. This seems to demonstrate even more dramatically than the various interpretations from the commentators of the school that the passages which form the basis for a "second look" at the problem of method in the Aristotelian tradition had a great impact upon sixteenth-century discussions. Abounding with additional aspects, new questions and alternative answers, these passages did not easily fit into the systematic reconstruction of the Aristotelian philosophy which had been the purpose of the *Commentator* Averroes and the Medieval scholastics and which, in the field of method, had produced the *regressus*. Yet, just as these passages resisted a smooth integration into the traditional teaching on method, they were obviously able to provide inspiration and orientation in the methodological debate at a moment in which the Aristotelian philosophy in general and the Aristotelian philosophy of nature in particular was experiencing a continuously accelerating process of transformation. In the context of this paper it has been possible only to sketch in the growing influence of these passages in sixteenth-century Renaissance philosophy and to point to some of the more interesting topics and some of their interpretations in the commentary tradition. There is much work still to be done.

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[135] Aristotle, *De partibus animalium* I,1; 640a10-641a14.

[136] Bernardino Telesio, *De rerum natura iuxta propria principia* (as note 132), VIII,15, vol. III, 232-9.

[137] Aristotle, *De partibus animalium* I,1, 641a32-b10.

VELOCIDAD *QUO AD EFFECTUS* Y VELOCIDAD *QUO AD CAUSAS*: LA TRADICIÓN DE LOS CALCULADORES Y LA METODOLOGÍA ARISTOTÉLICA

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I

En varios pasajes de la *Física*, Aristóteles lleva a cabo un estudio cuantitativo del movimiento local considerando conjuntamente los factores que lo producen y lo retardan –sus causas o "fuerzas" y sus resistencias–, el tiempo, y el espacio recorrido. Aunque en ningún momento la noción de velocidad se constituye en objeto de investigación *per se*, la determinación aristotélica de "más veloz" juega en ellos un rol central.[1] Así, por ejemplo, En *Física* IV, 8 compara velocidades de acuerdo con la variación de los medios –pleno o hipotéticamente vacío– que determinan la sucesión temporal, y de acuerdo con el peso de los móviles; en VII, 4 aborda el problema mismo de la comparabilidad de los diferentes tipos de movimientos y; en VII, 5, ofrece una serie de reglas que relacionan conjuntamente los cuatro tipos de factores mencionados antes: fuerzas, resistencias, espacio y tiempo.[2]

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[1] *Física* VI, 2, 232a 25-27: "Puesto que toda magnitud es divisible en magnitudes (....) se sigue necesariamente que, de dos cuerpos en movimiento, el más rápido recorrerá una distancia mayor en un tiempo igual, una distancia igual en un tiempo menor y una distancia mayor en un tiempo menor" (Aristóteles, *Física*, introducción, traducción y notas de G. R. De Echandía, Madrid 1995, 341). "Necesse est velocius in aequali tempore maius et in minori plus moveri sicut definiunt quidam ipsum velocius" (*Aristoteles Latinus* VII 1, Fasc. Secundus: *Physica*, *translatio vetus*, ed. F. Bossier et J. Brams, Leiden/New York 1990, 220); con una variante menor de puntuación igual tradución en el texto de S. Thomae Aquinatis, *In octo libros physicorum Aristotelis expositio,* al cuidado de P. M. Maggiòlo, Taurini/Romae 1954, 381). Cf. también *Física* IV, 10, 218b 15-7 y VII, 4, 249a 8-9. A fin de distinguirlo del enfoque definicional (*Fís.* III, 1-3) y del enfoque sistemático (*Fís.*, V), y sin querer para nada significar además "medición real" ni involucrar ningún tipo de técnica empírica de control cuantitativo, me parece adecuado hablar de un enfoque o tratamiento "cuantitativo" del movimiento, caracterizado por su relación al concepto de continuidad (*Fís.* VI) y por empleo de proporciones en los factores que determinan la velocidad (*Fís.* VII, 5).

Por otra parte, Aristóteles lleva a cabo este estudio del movimiento en torno del concepto velocidad sin conexión aparente con las observaciones metodológicas que abren el texto de la *Física*. En efecto, en el libro I, capítulo 1, se propone un modo de proceder según el cual se ha de comenzar por aquellas cosas más cercanas o manifiestas a nosotros (*notiora* o *manifestiora nobis*) para alcanzar luego las más cognoscibles y ciertas en sí mismas o según la naturaleza (*notiora naturae* o *simpliciter*).[3] A *notiora nobis* –continúa Aristóteles en *Fís.* I,1– le corresponde lo más cercano a la sensación y, en este sentido, también el todo antes que las partes y lo general antes que lo particular.

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[2] Por ejemplo, las dos primeras reglas son establecidas así: "Supongamos que A es el moviente [el motor, causa o 'fuerza'], B la cosa movida [que ofrece resistencia], C la distancia según la cual es movida y T el tiempo en el cual es movida. Entonces, 1) en el tiempo T una fuerza igual a A hará que algo que es la mitad de B se mueva sobre el doble de la distancia C, y 2) lo hará mover sobre la distancia C en la mitad del tiempo T, pues de esta manera se mantendrá la proporción" (*Física*, VII, 5, 249b30-250a, las observaciones entre [ ] son mías). En la *translatio vetus*: "si igitur A quidem est movens, B autem quod movetur, quantacumque autem mota longitudo est C, in quantocumque est tempus in quo est D, in equali igitur tempore equalis potentia in quo est A medietatem ipsius B duplicationem ipsius C movebit, ipsum autem C in medietate ipsius D; sic enim erit analogia (cit. n. 1, 274). Para una presentación concisa de las siete reglas aristotélicas discutidas en *Fís.* VII, 5, cfr. J. E. Murdoch and E. D. Sylla, "The Science of Motion," en: D. C. Lindberg (ed.), *Sciences in the Middle Ages*, Chicago/London 1978, 256-7, n. 55.

[3] *Física* I, 1, 184a10, 8-10. "La vía natural consiste en ir desde lo que es más cognoscible y más claro para nosotros hacia lo que es más claro y más cognoscible por naturaleza, porque lo cognoscible con respecto a nosotros no es lo mismo que lo cognoscible en sentido absoluto. Por eso tenemos que proceder de esta manera: desde lo que es menos claro por naturaleza, pero más claro para nosotros, a lo que es más claro y cognoscible por naturaleza" (trad. esp. cit., 83). "Innata autem est ex notioribus nobis via et certioribus in certiora naturae et notiora; non enim eadem nobis nota et simpliciter. Unde quidem necesse secundum modum hunc procedere ex incertioribus naturae nobis autem certioribus in certiora naturae et notiora" (*Aristoteles Latinus, translatio vetus* [cit. n. 1], 3). La *translatio vaticana* lleva "manifestior" (cf. *Aristoteles Latinus* VII 2, *Physica, translatio vaticana*, ed. A. Mansion, Leiden/New York 1957/1990, texto, 3). En adelante emplearé las expresiones *notiora nobis* y *notiora naturae*, descuidando las demás variantes. Todos los textos citados pueden ser provechosamente compararados con la versión latina (seguramente la *translatio vetus*) que acompaña la exposición de Tomás de Aquino y cuya puntuación aligera la lectura (cit. n. 1).

La misma distinción y la misma asociación entre la sensación y *notiora nobis* aparecen también en los *Analíticos Posteriores* I, 2.[4] Tanto aquí, donde se destaca el carácter causal del razonamiento científico por oposición a la mera deducción, como en *Física* I, 1, donde se señala la necesidad de abordar las causas, principios y elementos, quedaba latente la posibilidad de interpretar la expresión *notiora naturae* o *simpliciter* como "causa" y, con ello, dejar establecida la noción de causa como una noción que refiere a algún tipo de entidad lejana a la sensación. A su vez, si la expresión *notiora naturae* podía ser entendida como lo que es causa, su correlato *notiora nobis* podía ser entonces visto bajo "lo causado" o *effectus*; con lo cual, todo lo categorizable bajo "*effectus*" podía obtener complementariamente el doble carácter de la confiabilidad que corresponde a la sensación como punto de partida de la ciencia y, a la vez, el hecho de ser sólo un punto de partida y no estricto conocimiento. Sin embargo, ni Aristóteles mismo ni las traducciones latinas –como hemos visto– hablan en ninguno de estos textos de *effectus* sino únicamente de *notiora nobis*.

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[4] "Ahora bien, [las mencionadas cosas] son anteriores y más conocidas de dos maneras: pues no es lo mismo lo anterior por naturaleza y lo anterior para nosotros, ni lo más conocido [en sí o 'por naturaleza'] y lo más conocido para nosotros. LLamo anteriores y más conocidas para nosotros a las cosas más cercanas a la sensación, y anteriores y más conocidas sin más a las más lejanas..." (Aristóteles, *Tratados de lógica (Organon) II. Sobre la interpretación. Analíticos primeros. Analíticos segundos.* Introducciones, traducciones y notas de Miguel Candel Sanmartín, Madrid 1988, 317; aquí *Anal. seg.*, I, 2, 71b33-72a6). Para unificar el vocabulario me referiré a esta obra empleando el adjetivo "posteriores/ra" en lugar de "segundos". La traducción anónima vierte el pasaje así: "Priora autem sunt et notiora dupliciter; etenim non idem prius natura et ad nos prius, neque notius natura et nobis notius. Dico autem ad nos quidem priora et notiora propinquiora sensui, simpliciter autem priora et notiora que sunt longius". *Aristoteles latinus* IV 2: *Analytica posteriora, translatio anonyma*, ed. L. Minio-Paluello, Bruges/Paris 1953, 9; cfr. trad. en S. Thomae Aquinatis, *In Aristotelis libros Peri Hermeneias et Posteriorum Analyticorum expositio*, al cuidado de R. M. Spiazzi, Taurini/Romae 1964, 159). En este trabajo omitiré el problema de las relaciones entre universal-singular y todo-parte según las distintas aproximaciones ofrecidas por Aristóteles en *Fís.* I, 1 y *Anal. Post.* I, 2 y discutidas luego extensamente a partir de Averroes.

II

Hasta donde alcanza mi conocimiento, un completo y genuino estudio del concepto de *efecto* –que excede ampliamente los límites de este artículo– todavía no ha sido llevado a cabo. El término *effectus* es sin duda de uso corriente ya en el latín clásico y no es improbable que hubiera existido una estrecha conexión entre *causa* y *effectus* antes de que la *Física* aristotélica comenzara a ser comentada.[5] Si esto es así, resultaría comprensible entonces su aparición en aquellos pasajes en los que, como los recién citados, el contexto es decididamente causal.

Sin embargo, esto no significa que el concepto de efecto carezca de contenido propio o que éste se agote en la mera función complementaria de satisfacer los requisitos de una estructura dualista *principia-principiata, elementa-elementata, causa-causata.*[6] Si no lo poseía ya antes, él recibe aquí la determinación gnoseológica –que no ha permanecido inoperante– de "más conocido para nosotros".

Se podría en principio suponer que el empleo de *effectus* es tan frecuente y en cierta forma convencional dentro de este marco teórico, que carece de relevancia y, por tanto, no ofrece dificultad histórico-conceptual alguna. Sin embargo, no es así. Por más extendida que haya sido a partir del siglo XIV –como de hecho lo fue–, *effectus* no parece haber sido la clave hermenéutica para la interpretación de *notiora nobis* en algunos textos, por cierto no irrelevantes, anteriores al siglo XIV.

En efecto, mientras Roberto Grosseteste en su famosa exposición de los *Analíticos Posteriores* I, 12, en la cual son discutidos los problemas de subalternación y los tipos de demostración científica correspondientes a cada disciplina, claramente caracteriza la demostración "*quia*" como una "*demonstratio per effectum*", sus anotaciones a la *Física* ni siquiera mencionan el par metodológico "causa/efecto". Grosseteste se concentra casi exclusivamente en el concepto inicial de "principio" anticipando así su exposición posterior sobre "materia" y "forma".[7]

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[5] De aquí no se desprende que "*effectus*" poseyera ya el sentido que asume luego en los comentarios aristotélicos (ver la entrada correspondiente en el *Thesaurus Lingua Latinae*, V,2 (E), Leipzig 1931-1953, 128-35).

[6] Así, por ejemplo, expresa Buridán su cuestión cuarta al libro I: "utrum in omni scientia ex preexistenti congnitioni principiorum causarum et elementorum contingit alia scire et intelligere, scilicet principiata, causata et elementata" (*Subtilissime questiones super octo physicorum libros Aristotelis*, París 1509; Reprint: Frankfurt 1964, L. I, q. 4, fol. 4va). Pero *cfr. infra* n. 15.

Alberto Magno lo utiliza en *Física* II en su clasificación de las causas, pero en I,1 se limita a emplearlo para caracterizar la *scientia* como resultado de la demostración.[8] Análogamente, Tomás de Aquino usa *effectus* asiduamente en varios textos pero, sin emplearlo él mismo en su exposición de *Física* I,1, atribuye curiosamente a Averroes una interpretación de estos pasajes que incorpora el término *effectus*, a pesar de que sin embargo éste no aparece en las traducciones del Comentador.[9]

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[7] "et si fuerit notior quam sua causa, tunc per effectum fit demonstrario quia..." (Cf. Robertus Grosseteste, *Commentarius in Posteriorum Analyticorum Libros*, Introduzione e texto critico di P. Rossi, Firenze 1981, 193. Sobre problemas del método y subalternación en Grosseteste cf. R. Laird, "Robert Grosseteste on the Subalternate Sciences," en: *Traditio* 43 (1987), 147-69 y W. A. Wallace, *Causality and Scientific Explanation*, 1: *Medieval and Early Classical Science*, Ann Arbor 1972, 29-47. Comparar con *Roberti Grosseteste Episcopi Lincolniensis Commentarius in VIII Libros Physicorum Aristotelis*, ed. R. Dales, Boulder 1963, 1-2.

[8] En el capítulo 6 Alberto Magno trata "de comparatione causarum ad effectus et inter se" (Albertus Magnus, *Opera omnia*, ed. B. Geyer, Münster/Aschendorf 1968,vol 4, 105-6). El empleo de *effectus*, alusivo a *Fís.* I, 1, se limita al siguiente pasaje sin conexión directa con *notiora nobis*: "Dico autem, quod omnis scientia, quae habet principia, sic procedit, et illa sola est vere scientia, quia est demonstrativa et effectus solius demonstrationis est scire. Si autem ipsa no habeat verum nomen scientiae, tunc ipsa erit scientia topica dialecticae vel rhetoricae, et effectus eius non erit scientia, sed opinio vel suspicio sive praesumptio" (8).

[9] "Sciendum autem quod Commentator aliter exponit.
Dicit enim quod ibi, *Innata autem est*, etc., vult ostendere Philosophus modum demonstrationis huius scientiae, quia scilicet demonstrat per effectus et posteriora secundum naturam: ut sic quod ibi dicitur, intelligatur de processu in demonstrando, et non in determinando". (*In octo physicorum* [cit. n. 1], 5). Averroes distingue *notior apud nos* y *apud naturam* según su cercanía o lejanía con la sensación. Las traducciones latinas impresas de Averroes mencionan las causas pero parecen desconocer el término "*effectus*"; *cfr.* los pasajes en el Comentario Magno (*Aristotelis ... Posteriorum Resolutoriorum ... magnis commentariis*, Venecia 1562-1574; Reprint: Frankfurt 1962, I, 2a, commt. text. 5, fol. 36r) y en la Exposición Media (*Averroes expositionis mediae in librum demonstrationis Aristotelis*, *idem*, I, 2b u.3, fol. 2F 12). Lo mismo en *Fís.* I, 1: Averrores comenta el pasaje correspondiente reestructurando según los tipos de demostración y así, conectando con los *Anal. Post.*. De esta manera la "via ex rebus posteriobus" a partir de los sentidos hacia las causas es expresada como el tipo de demostración "*signum*", pero el término "*effectus*" no es introducido (*Cfr. Aristotelis de physico auditu libri octo cum Averrois Cordubensis variis in eosdem Commentariis*, ed. citada, vol. IV, Venecia 1562, Lib. I, cap. 2, 6-7). Tomás dice en el libro II "causis debent proportionaliter respondere effectus" (ibid., 98; cfr. lo

En cambio, la conexión entre *notiora nobis* y *effectus* se encuentra ya con un carácter de cierta convencionalidad en los comentarios y *quaestiones* del siglo XIV, o incluso en otros textos que se apoyan en los pasajes metodológicos antes citados.[10] Un buen ejemplo de este nuevo enfoque se encuentra en la oportuna referencia a Walter Burley que contiene la edición de R. Dales de la *Physica* de Grosseteste, donde vemos que Burley no sólo ha abiertamente seguido a Grosseteste ("*expositio Lynconensis dicit...*") en su segundo Comentario a la *Física* sino que lo ha completado introduciendo ciertos *notanda* y *dubitanda* en los cuáles –nuevamente con mención a Averroes– se destaca que en la Física y en la Metafísica, a diferencia de las Matemáticas, se debe proceder "ab effectibus ad causas et ex posteriobus ad priora."[11]

Discutiendo en su *Expositio* una objeción según la cual "cognitio causarum praesupponeret cognitionem effectuum", Ockham anota que "essentialior est ordo procedendo a causis ad effectus quam e converso"[12]. Explicando el *modus procedendi* en la *Summula philosophia naturalis,*

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mismo en *Peri Hermeneias* [cit. n. 3], 72). En los *Analíticos Posteriores* emplea frecuentemente *effectus*. Así, al exponer el texto antes citado anota: "omnis causa est naturaliter prior et notior suo effectu" (cit. n. 4), 162.

[10] "Cum igitur innata sit nobis via investigande veritatis circa naturalia ex notioribus nobis, nature vero minus notis, in certiora nature et notiora, ut patet ex primo Phisicorum, et notiores sint nobis in talibus effectus quam cause –quia per ipsos inducimur in cognitionem causarum, ut patet, quia eclipsis solis duxit in cognitionem interpositionis lune, unde propter admirari cepere phylosophari–, viam inquisitionis in naturalibus oportet esse ab effectibus ad causas"; Dante Alighieri, "Quaestio de aqua et terra", al cuidado de F. Mazzoni, en *Opere minori*, Milano/Napoli, vol 2, 764. El ejemplo del eclipse corresponde a *Anal. Post.* I, 13, 78a 25-45, donde Aristóteles distingue los dos tipos de demostración que luego serán frecuentemente discutidos como *quia* y *propter quid.*

[11] W. Burley, *Expositio physicorum*, Venecia 1589; citado por Dales (R. Grosseteste [cit. n. 7], 2 n. a-a').

[12] Guillermo de Ockham, *Opera Philosophica et Theologica,* IV: *Expositio in libros physicorum aristotelis*, eds. V. Richter y G. Leibolf, New York 1985, 17. Sylla observa que, en realidad, Burley podría haber reaccionado con su segundo comentario antes citado contra la *expositio* de Ockham. Mientras éste daría lugar a una fundamentación "a posteriori" de la física, Burley pretende asegurar la física "a priori" (cfr. E. D. Sylla, "The A Posteriori Foundations of Natural Science. Some Medieval Commentaries on Aristotle's *Physics*, Book I, Chapters 1 and 2," en: *Synthese*, 40 (1979), 174-5). Sylla traduce y, analizando el texto recién citado en un contexto distinto al de este artículo, interpreta que para Ockham "the knowledge of effects is more fondamental than the knowledge of causes. Despite this, in order to explain Aristotle's view, he says that the order from causes is more essential" (171).

introduce además la *demonstratio propter quid* –y con ello subrepticiamente también la *demonstratio quia*– como categorías de análisis del pasaje metodológico inicial de la *Física.*[13] Juan de Jandun, por su parte, afirma la prioridad cognoscitiva *simpliciter* de las causas en relación a lo causado, y sostiene además que los efectos –como toda entidad ontológicamente inferior– son más cognoscibles para nosotros.[14] Textos de gran difusión posterior, como las *quaestiones* de Buridán, incluyen referencias explícitas al modo de proceder y de demostrar en la ciencia natural, con especial mención al problema de la circularidad demostrativa, pareciendo incluso suponer que Aristóteles mismo habría hablado de "efectos" en *Física* I, 1 o en los pasajes paralelos de los *Analíticos Posteriores.*[15]

La importancia de los campos en los que aparece también podría convencernos de que no se trata de una pura cuestión filológica.[16] En primer lugar y en la medida en que representa –cuanto menos– el punto de partida a través de la *demonstratio quia*, es decir del procedimiento científico que transcurre a partir de los efectos, podemos afirmar sin exageración que se trata de un elemento básico de la doctrina del método: no sin motivo, sino porque justamente al encontrarse los efectos más cercanos a la sensación son ellos "más conocidos para nosotros". Todavía más: en cuanto el procedimiento demostrativo podría llevarse a cabo en la ciencia natural dando lugar a un así llamado *"regressus demonstrativus"*, cuyo primer paso tiene lugar según una *demonstratio quia*, el concepto de *effectus* ya es digno de atención.[17] En segundo lugar, la compresión de los efectos como "más conocidos para nosotros" ha posibilitado ciertas conexiones entre los problemas metodológicos y epistemológicos relativos al tipo de demostración (*quia* o *propter quid*), saber o ciencia (*a posteriori* o *a priori*), y el análisis de la velocidad según los efectos (*quo ad effectus*) y según las causas (*quo ad causas*) iniciado en Merton College e incorporado luego en varios tratamientos standard de la filosofía natural. Esta conexión constituye un fenómeno de primera importancia a la hora de analizar la forma según la cual se constituye y desarrolla la tradición aristotélica y, dentro de ella, la tradición de los *calculatores*. En tercer lugar, aquella determinación gnoseológica del *effectus* ha conducido a su "*quasi*" identificación con el espacio recorrido en el movimiento local, con lo cual ha jugado también un papel conceptual no despreciable en la física y, más precisamente, en el estudio de la velocidad.

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[13] "Circa quod dicendum est quod quamvis in hac scientia sint demonstrationes propter quid, sicut in ceteris scientiis, ordine tamen doctrinae qui incipere debet a notioribus et facilioribus communitati cui tradenda est scientia, procedendum est ab effectu ad causam et a communioribus ad minus communia" (Guillermo de Ockham, *Opera Philosophica et Theologica*, VI: *Summula philosophiae naturalis*, ed. S. Brown, New York 1984, 152). La atribución de las *Summulae* ha sido objeto de discusión (cfr. A. Goddu, *The Physics of William of Ockham*, Leiden/Köln 1984, 4-6 y la bibliografía aquí citada).

[14] "Nam causae sunt notiores simpliciter et secundum naturam ipsis causatis, ut vult Aristoteles in litera" (*Super octo libros aristotelis de physico auditu subtilissimae quaestiones*, Venecia 1551; Reprint: Frankfurt 1969, 5H). Mostrando luego en la conclusión que "in naturalibus et divinis" lo más conocido en sí y para nosotros no son lo mismo, pero sí "in matematicis", afirma: "quia in quocunque genere, effectus, et ea, quae sunt posterioris entitatis, sunt notiora quo ad nos(...), effectus sunt nobis notiores quam causae, quia effectus sunt simpliciter posteriores, et notiora quo ad naturam sunt principia et causae, quae sunt priora simpliciter. Nam ea, quae sunt nobis notiora, in Metaphysica, quo ad principalem eius partem, sunt motus et tempus et numerus motum coelestium" (ibid., B-C).

[15] "Descendendo ad textum," dice Buridán: "Nec valet dicere quod licet effectus sunt nobis notiores, tunc cause sunt notiores nature, sicut dicit Aristoteles, ideo propter illam notioritatem possunt ex eis notificari causata (...) Et iterum sicut dicit Aristoteles ex effectibus nobis notioribus oportet procedere ad sciendum causas; igitur non econverso, quia esset circulatio et in primo posteriorum dicitur quod circulariter demonstrare est impossibile"; (*questiones super octo physicorum* (cit. n. 6), L. I, q. 4, fol. 4vab).

[16] Sin llamar la atención sobre el significado de "effectus" y su conexión con *notiora nobis*, E. D. Sylla y más recientemente S. Donati han estudiado en profundidad varios comentarios –especialmente ingleses– a *Física* I, 1: Sylla (cit. n. 12), 147-87; S. Donati, "Physica I,1: L' interpretazione dei commentatori inglesi della *translatio vetus* e la loro recenzione del commento di Averroè," en: *Medioevo.*

Rivista di storia della filosofia medievale, 21 (1995), 75-255. Sylla se concentra más bien en la noción de "principio". No obstante de acuerdo con los textos citados por ella parece que el lenguaje de efectos=*notiora nobis* contrapuesto a causas=*notiora naturae* se establece como convencional durante el siglo XIV. Además, me parece que difícilmente se podría negar su importancia para la por Sylla así llamada "foundation a posteriori" de la física (cfr. p.e. el Anónimo del Ms. Peterhouse 192 citado en 167 y 183 n. 70).

[17] De la extensa bibliografía sobre *regressus demonstrativus* selecciono tan sólo J.H. Randall, quién ha enfatizado el papel del método en "The Development of Scientific Method in the School of Padua," en: *Journal of the History of Ideas* 1 (1940), 177-206, y *The School of Padua and the Emergence of Modern Science*, Padua 1961. Más recientemente W. A. Wallace ha retomado el problema a partir de los escritos juveniles de Galileo sobre lógica y metodología en su *Galileo's Logic of Discovery and Proof. The Background, Content, and Use of His Appropriated Treatises on Aristotle's Posterior Analytics* (Boston Studies in the Philosophy of Science 127), Dordrecht/Boston/London 1992 (ver la bibliografía 304-12).

Aunque un estudio exhaustivo requeriría de mucho mayor espacio que el disponible, intentaré fundamentar mi punto de vista relativo a las dos últimas cuestiones recién mencionadas tomándolas en bloque y recorriendo un conjunto de autores que, creo se podrá convenir, constituyen poco más o menos la columna vertebral de la tradición de los *calculatores* desde su comienzo en el siglo XIV hasta el siglo XVI.

III

El empuje inicial para la incorporación de la noción de *effectus* en el tratamiento cuantitativo del movimiento y para posibilitar con ello su ulterior intento de unificación con las premisas metodológicas antes señaladas, no fue dado tanto por los comentaristas de los textos aristotélicos sino sobre todo por Bradwardine y sus continuadores del Merton College,[18] quienes se ocuparon de problemas de lógica y filosofía natural componiendo tratados especiales antes que recurriendo a la forma del comentario o cuestiones.

En su *Tractatus de proportionum velocitatum in motibus* (1328), Thomas Bradwardine ha ofrecido no sólo una nueva “ley del movimiento” sino además un nuevo punto de vista en el tratamiento de las cuestiones de filosofía natural.[19] Tratándose de un tratado independiente y no de un comentario, los textos aristotélicos traídos a colación son reorganizados y conectados unos con otros bajo los criterios y punto de vista de

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[18] En lo que sigue, y a pesar de las oportunas consideraciones de E. Sylla, me permitiré cierta libertad en el empleo de los términos “calculadores” y “mertonenses”, cuyo significado podrá ser determinado en el contexto del trabajo. En general me refiero con “mertonenses” a los autores como Bradwardine, Heytesbury, Richard Swineshead, que constituyen el “núcleo” de la tradición de los “calculadores”, dentro de los cuales se cuentan sin duda también autores como Gaetano da Thiene, Alvaro Thomaz y otros que desarrollan el programa inicial, naturalmente corrigiendo lo que consideren necesario (E. D. Sylla, “The Oxford Calculators,” en: N. Kretzmann, A. Kenny y J. Pinborg (eds.), *The Cambridge History of Later Medieval Philosophy*, Cambridge 1982, 540-63.

[19] H. L. Crosby, *Thomas of Bradwardine. His Tractatus de Proportionibus. Its Significance for the Development of Mathematical Physics*, Madison 1955. Este texto fue editado en París, no antes de 1481; probablemente en Bologna 1506, en forma abreviada en Viena 1515; y junto al de Oresme y otros tratados sobre las proporciones en Venecia 1505. Esta última edición posee una introducción (fols. 9r-10rb) titulada *Summula de motu* (ed. y trad. en M. Clagett, *The Science of Mechanics in the Middle Ages*, Madison 1959, 454-62) que no pertenecería a Bradwardine o que, en todo caso, con seguridad no forma parte de su *Tractatus de proportionibus*.

Bradwardine: el estudio del movimiento (i.e. la filosofía natural) debe incorporar el empleo de las matemáticas.[20] No se trata del tipo de retórica más o menos matematizante del platonismo, sino de una exposición matemática sobre los conceptos de "proporción" y "proporcionalidad" siguiendo la entonces bien conocida *Arithmetica* de Boecio/Nicómaco de Gerasa y el libro V de los *Elementos* de Euclides. Un de los resultados centrales es, como se sabe desde A. Maier, la nueva "ley" o "regla" del movimiento de Bradwardine.[21] Ahora bien, este nuevo enfoque en la filosofía natural es puesto en práctica por Bradwardine en el marco de una distinción entre los factores que Aristóteles había tratado conjuntamente, estudiando primero el movimiento "in comparatione ad moventium et motorum potentias" y luego "in comparatione ad moti et spatii pertransiti quantitates."[22] Este aspecto organizativo y casi metodológico del *Tractatus*, en el que se ha querido encontrar el antecedente escolástico de nuestra moderna distinción entre dinámica y cinemática,[23] resultó altamente fértil en la futura tarea de incorporar técnicas mertoneses dentro del aparato de la *Física* aristotélica y, con ellas los *mathematicalia* "euclídeo-boecianos" dispuestos para su preparación. Para ello fue necesario todavía que la importante diferenciación entre los dos órdenes de –por así llamarlos– factores cuantitativos del movimiento que Aristóteles había empleado conjuntamente, adquirieran una forma más cercana a los criterios mediante los cuáles se leía el texto aristotélico: el análisis según las *potentiae* pasará a ser llamado *quo ad causas*, el análisis según el espacio recorrido (en el movimiento local) se convertirá en *quo ad effectus*.[24]

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[20] El texto comienza: "omnem motum successivum alteri in velocitate proportionari contingit; quapropter philosophia naturalis, quae de motu considerat, proportionem motuum et velocitatum in motibus ignorare non debet" (ibid., 64). El primer capítulo son ciertos "mathematicalia" que luego serán empleados en el estudio del movimiento.

[21] Bradwardine descarta tres reglas que se acostumbra a expresar de la siguiente manera : 1) $V = F-R$; 2) $V = (F-R)/R$; 3) $V = F/R$ (Aristóteles), donde V representa la velocidad sin connotaciones vectoriales, F la "fuerza" o causa del movimiento y R la resistencia. La nueva regla propuesta por Bradwardine establece que 2V no se obtendría correctamente por duplicación 2F de la fuerza o partición R/2 de la resistencia sino por potenciación $(F/R)^2$ del cociente entre F y R. Análogamente para 3V será necesaria $(F/R)^3$, etc. Del mismo modo se recurrirá a radicación para calcular la disminución V/2, etc. Dado que Bradwardine no expresa su regla mediante una ecuación sino verbalmente, se han propuesto diversas formas de expresión. A. Maier (*Die Vorläufer Galileis im 14. Jahrhundert*, Roma ^{2}1966, 91-2) fue la primera en descubrir que *la idea* que se esconde tras la expresión de Bradwardine sería expresable hoy como $V = \log_a F/R$, donde $a = F_1/R_1$ (siendo estos los valores iniciales anteriores a la variación de velocidad). E. Grant recomienda una expresión libre de logaritmos (que él mismo caracteriza como "anacrónica pero adecuada"): $F_2/R_2 = (F_1/R_1)^n$, donde $n = V_2/V_1$ (E. Grant, *Nicole Oresme: De proportionibus proportionum and Ad pauca respicientes*, Madison/Milwaukee/London 1966, 17).

[22] *Ibid.*; ambos puntos de vista corresponden respectivamente a los capítulos 3 y 4.

[23] En la introducción a su edición del *De proportionibus* de Bradwardine, Crosby acusa Maier de haber perpetuado la atribución de Duhem, según la cual la distinción entre dinámica y cinemática se reconduce a Alberto de Sajonia (y, se sobreentiende, no más atrás hasta Bradwardine (cit. n. 19), 53). Con razón A.

Maier replica en su reseña para *Isis* (48 [1956], 84-7) de Bradwardine/Crosby ya haber afirmado en varias oportunidades que la distinción discutida comienza con Bradwardine, en quien se basa Alberto. Pero, como vemos, la discusión versa sobre si la distinción comienza con Bradwardine o Alberto de Sajonia. De que la distinción *quoad causas – quoad effectus* refleja nuestra moderna distinción entre dinámica y cinemática no se duda; A. Maier dice: "Die moderne Physik pflegt die Bewegungsvorgänge unter doppeltem Gesichtspunkt zu betrachten und in der Wissenschaft von ihnen zwei Zweige zu unterscheiden: die Dynamik und die Kinematik. Die erstere fragt nach den Ursachen der Bewegungen und Bewegungsänderungen, d.h. nach den Kräften, die sie hervorrufen, den Widerständen und ihren Wirkungen usw., die letztere abstrahiert von all dem und beschreibt und vergleicht lediglich die Bewegungen als solche. Es ist *genau dieselbe Unterscheidung*, die das 14. Jahrhundert, nach Bradwardines Tractatus proportionum (1328), *in expliziter Form* gemacht hat und die durch die doppelte Problemstellung charakterisiert wurde: penes quid attenditur velocitas tamquam penes causam? und penes quid attenditur tamquam penes effectum?" (al pie de página remite a Alberto de Sajonia. A. Maier, *Die Vorläufer (*cit. n. 21), 111, énfasis mío). M. Clagett, asume esta distinción como correlativa a "dinámica" y "cinemática", empleando ambas junto con "estática" como estructura principal de su *The Science of Mechanics* (cit. n. 19). Clagett se expresa muy cuidadosamente "mutatis mutandi" para la dinámica –no para la cinemática–, cuyo concepto newtoniano de fuerza es radicalmente distinto del concepto aristotélico de causa (cfr. 163). A partir de Clagett y Maier se ha extendido esta interpretación hasta convertirse en standard. Ver p.e. Busard, quién cita a Clagett afirmando la diferenciación "in expliziter Form" (palabras de Maier) entre "Dynamik" y "Kinematik" en el tratado de Bradwardine, al cual le sigue el propio de Alberto de Sajonia, que él comenta y edita (cfr. H. H. L. Busard, "Der 'Tractatus proportionum' von Albert von Sachsen," en: *Österreichische Akademie der Wissenschaft, mathematisch-naturwissenschaftliche Klasse: Denkschriften*, 116. Band, 2. Abhandlung, Wien/New York 1971, 43). Cfr. además n. 68 sobre J. Weisheipl.

[24] Por comodidad empleo corrientemente estas dos expresiones para sintetizar la idea también localizable como *quoad causam* y *effectum*, o *tanquam penes causam/effectum*, etc. En el análisis causal se discuten las cuatro reglas del movimiento mencionadas antes en n. 21 (eventualmente también la suposición

Richard Swineshead, conocido luego como el "*Calculator*", fue uno de los primeros en emplear esta distinción. Ella no es expresamente enunciada, sin embargo, en su famoso *Liber calculationum* (ca. 1340-1350), sino en dos de los tres *opuscula* que hoy le son adjudicables según los historiadores modernos. En un breve texto *De motu*, Richard enuncia la distinción de Bradwardine bajo la forma *"quo ad causam – quo ad effectum"*. Así como aquél había comenzado por las *potentiae*, el Calculator comienza ahora *quo ad causam*, sólo que él señala además el carácter metodológico y, ciertamente, aristotélico de la nueva expresión remitiendo al primer capítulo de la *Metafísica* de Aristóteles.[25] En sus *Regule de motu locali*, Richard enuncia y emplea nuevamente la distinción, estableciendo de modo general la correspondencia entre causa y efecto como fundamento del análisis de la velocidad.[26] Una tal

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básica sobre si existe en general la posibilidad de establecer una tal regla). En el análisis según los efectos, se establece la cantidad de "*perfectio*" adquirida –para usar el lenguaje de Oresme– para los tres tipos de movimiento: cualitativo, cuantitativo y local (en este caso es el espacio recorrido en un determinado lapso de tiempo). Para una presentación de los resultados según ambos enfoques en el siglo XIV ver el excelente artículo de J. Murdoch, "*Mathesis in Philosophiam Scholasticam Introducta*. The Rise and Development of the Application of Mathematics in Fourteenth Century Philosophy and Theology," en: *Arts libéraux et philosophie au moyen âge. Actes du Quatrième Congrès International de Philosophie Médiévale*, Montreal/Paris 1969, 225-38.

[25] "Cum omnis effectus naturales per motum ad esse producitur inquisitioni naturalium volenti insistere precognitio motus esse necessaria dinoscitur. Et per Philosophum primo *Metaphysice* perfecte non cognoscitur res aliqua nisi per suas causas propinquas et remotas. Ideo motum cognoscere volenti ipsius causas principales expediens est investigare que sunt materialis, formalis, efficiens, et finalis". Luego de una breve aclaración sobre cómo deben entenderse estas cuatro causas Swineshead comienza *quo ad causas*: "...dimissa tarditate penes quid quo ad causam et ad effectum in quacumque motu attendatur velocitas diligentius est inquirendum. Quia perfecta cognitio cause precidit cognitionem effectus, primo notandum est penes quid attenditur velocitas in motu quo ad causam...". Después de ello, Swineshead aborda el estudio *quo ad effectus*: "Dicto generaliter quid habet attendi velocitas in quocunque motu quo ad causam, videndum est penes quid attenditur in motu quo ad effectum" (en: E. D. Sylla, *The Oxford Calculators and the Mathematics of Motion. Physics and Measurement by Latitudes*, New York/London 1991, 634 para los dos primeros párrafos y 636 el último; también Clagett (cit. n. 19), 208 y 245).

[26] "Quia prius dictus est diffuse de velocitate motus quo ad eius causam, videlicet quod sequitur proportionem potentie motive ad potentiam resistivam, et causam sufficientem universaliter sequitur suus effectus correspondes, videtur igitur modo dicendum penes quid attendi debeat velocitas motus quo ad eius effectum" (en Sylla [cit. n. 25], 640; ver también Clagett [cit. n. 19], 209).

transferencia terminológica permitía a las generaciones posteriores no sólo la vinculación entre *Física* I, 1, y el doble punto de vista de Bradwardine sino también la expresión de determinados pasajes de *Física* IV, y sobre todo VI y VII, según la distinción *quo ad causas* y *quo ad effectus*. Con ello, se posibilitaba una legitimación metodológica de la extendida convicción según la cual la medida de la velocidad se calcula en términos de espacio recorrido.

La tradición mertonense, desarrollada a través de tratados independientes, fue doblemente retomada en París durante el siglo XIV. Por un lado se continuó la composición de tratados relativos al análisis cuantitativo del movimiento. Por otro, se incorporaron y reelaboraron aquellos análisis en el marco de *quaestiones* a la *Física* aristotélica.[27]

IV

Un primer paso en esta dirección adelantó Juan Buridán. Él parece haber tenido menor contacto que sus sucesores con los resultados y puntos de

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En el *De motibus naturalibus* (nunca impreso y hoy accesible en forma completa en sólo un Ms. de Erfurt, Ampl. F. 135) de *Roger* Swineshead (que no debe ser confundido con Richard, autor del *Liber Calculationum*), la distinción habría sido empleada –según Murdoch y Sylla– a la inversa: primero los efectos y después las causas: "Whereas later authors, especially Parisian-trained authors such as Albert of Saxony, generally discussed the measures of motion with respect to the cause first (*penes quid attenditur motus tanquam penes causam*) and then discussed the mesasures of motion with respect to effect (*tanquam penes effectum*), Roger begins with effects of motion (as, indeed, does the Calculator after him)" (J. E. Murdoch y E. D. Sylla, "Swineshead, Richard," en: *Dictionary of Scientific Biography*, New York 1976, vol. 13, 185). En qué medida esto es cierto con respecto a la forma según la cual de hecho Swineshead procede en su *Liber calculationum* es un asunto interpretativo a discutir. Entretanto, una tal afirmación parece ser sorprendentemente contradictoria con los pasajes de los *Opuscula* antes citados (por lo demás, mencionados también por los autores). La afirmación sobre Alberto de Sajonia, por otra parte, sería correcta para el *Tractatus proportionum*, pero no para sus *quaestiones physicorum* (*cfr. infra*, n. 37). Sobre Roger Swineshead ver E. D. Sylla, "Mathematical Physics and Imagination in the Work of the Oxford Calculators: Roger Swineshead's *On Natural Motions*," en: E. Grant y J. Murdoch (eds.), *Mathematics and Its Application to Science and Natural Philosophy in the Middle Ages*, Cambridge 1987, 69-101. Este importante artículo contiene un *Appendix* con transcripción de varios de los pasajes analizados.

[27] Cf. J. Sarnowsky, "Natural philosophy at Oxford and Paris in the Mid-Fourteenth Century," en: M. Wilks y A. Hudson (eds.), *From Ockham to Wyclif: Oxford Scholarship in the Later Fourteenth Century* (Studies in Church History, Subs. 5) Oxford 1987, 125-34.

vistas matematizantes de los mertonenses. Sin embargo, historiadores como Clagett y Grant han logrado establecer conexiones ciertas entre sus *quaestiones* a la *Física* y el Merton College. Buridán no organiza su discusión de la velocidad siguiendo el modelo *quo ad causas* y *quo ad effectus* pero en su análisis de las *regulae* aristotélicas conoce y asume la "ley de Bradwardine", que se transformará durante largo tiempo en la solución habitual para el cálculo según las causas[28].

Nicolás Oresme representa un momento central en la incorporación y desarrollo de los conceptos y métodos mertonenses dentro de la tradición parisina. A diferencia de Buridán, no se limitó a componer cuestiones o comentarios a los textos aristotélicos, sino que compuso además tratados independientes continuando en ellos el enfoque iniciado por Bradwardine.

Una serie de textos dispersos nos muestran cómo Oresme ha empleado ambos puntos de vista en el análisis de la velocidad. En su *Livre du ciel et du monde*, investigando "lo que es posible e imposible en relación a una fuerza motriz" manifiesta haberse ocupado antes de la comparación de la "potencia activa" al *effit* que ella produce, a la velocidad de su acción y al tiempo que dura.[29] Se trata de su *De configurationibus qualitatum et motuum*[30] o, más probablemente, de su *De proportionibus proportionum*.[31] En el primero, Oresme ha llevado a cabo un análisis de la velocidad obviando la cuestión de las fuerzas motrices y representando geométricamente la cantidad de cualidades y movimientos.

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[28] Para la conexión Bradwardine-Buridán, cfr. M. Clagett, *Nicole Oresme and the Medieval Geometry of Qualities and Motions*, Madison/Milwaukee/London 1968, 61-2; E. Grant (cit. n. 21) 45 n. 62; 15 n. 9. Buridán analiza las *regulae* aristotélicas en las *quaestiones* 6, 7, y 8 del libro VII (cit. n. 6, fols. 106va-108vb). La ley de Bradwardine encontró luego algunos oponentes importantes. Murdoch, como antes Maier, menciona a Blas de Parma y Giovanni Marliani (cf. J. E. Murdoch, "Bradwardine, Thomas," en: *Dictionary of Scientific Biography* (cit. n. 26), vol. 2, 390-7; A. Maier [cit. n. 21], 104-10). Clagett agrega a Alejandro Achillini y Benedetto Vittorio (M. Clagett [cit. n. 19], 443; cfr. además su *Giovanni Marliani and Late Medieval Physics*, New York 1941).

[29] "Aucunes puissances actives pueent estre comparees ou a l'effit que elles pueent faire, ou a la velocité ou isneleté de leur action ou movement, ou au temps ouquel elles pueent ouvrer, ou a autres choses et en moult de manieres selonc diverses circonstances. Et selonc ce pueent estre plusseures belles consideracions dont je ay autre foys traité, et m'en passe pour ce qu'elles ne sont pas propres a nostre principal propos" (Nicole Oresme, *Le Livre du ciel et du monde*, ed. A. Menut y A. Denomy, Madison/Milwaukee/London 1968, 193-4).

[30] Clagett (cit. n. 28).

[31] Grant (cit. n. 28). Este texto fue editado en Venecia 1505 y Paris, s.d.

De acuerdo con la doctrina entonces extendida Oresme expresa que la velocidad del movimiento local se mide por el espacio recorrido, el cual es a su vez entendido como cantidad de *perfectio* adquirida en un cierto intervalo de tiempo.[32] Es en este mismo texto donde, representando el espacio recorrido bajo el área de la *configuratio*, Oresme lleva a cabo su famosa demostración geométrica del teorema de la velocidad media enunciado por primera vez en las *Regule* de Heytesbury y de acuerdo a la historiografía standard no aplicado a la caída de los cuerpos hasta Domingo de Soto.[33] Por otra parte, en el establecimiento de los principios que regulan la construcción de las *configurationes*, en torno de las cuales él pretende edificar una *disciplina* capaz incluso de proporcionar las causas de efectos recónditos.[34] Oresme emplea las categorías de "mejor conocido para nosotros" y "mejor conocido según la naturaleza" para distinguir *extensio* de *intensio*.[35] En su *De proportionibus proportionum*, donde examina primero los fundamentos matemáticos de la "ley de Bradwardine", lleva a cabo un estudio de la velocidad según sus factores causales. Igual que Bradwardine, Oresme no habla aquí de *causae* sino de *potentiae.* No obstante, señala claramente ambos enfoques con explícita mención además a los textos de la *Física* y a los procesos metodológicos *"a priori"* y *"a posteriori"*. Este último consiste en demostrar la *proportio proportionum* (la relación entre fuerzas y resistencias según Bradwardine) a partir de la proporción de las velocidades. Cuando, por el contrario, comenzando por las causas y a partir de la *proportio proportionum* se da cuenta de la proporción de la velocidades, se trata a la inversa de un *processus a priori.*[36]

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[32] "Item sicut velocitas in motu locali secundum longitudinem spatii mensuratur..." Clagett (cit. n. 28), 168; "dico ergo quod universaliter ille gradus velocitatis est simpliciter intensior sive maior quo in tempore equali plus acquiritur vel deperditur de illa perfectione secundum quam fit motus. Verbi gratia, in motu locali ille gradus velocitatis est maior et intensio quo plus pertransiretur de spatio vel de distantia..." (ibid., 276).

[33] *De configurationibus*, ed. Clagett (cit. n. 28), 408-11. Sobre la aplicación del teorema W. A. Wallace, "The Enigma of Domingo de Soto: *Uniformiter difformis* and Falling Bodies in Late Medieval Physics," en: *Isis* 54 (1968), 384-401. Esta aplicación, que es tan sólo retórica y no involucra procedimiento de control empírico alguno, fue en mi opinión anticipada por Paulus Venetus, a partir del cual reelabora Domingo de Soto su sección correspondiente a Phys. VII (cfr. infra n. 37 y Daniel A. Di Liscia, "Die fallenden Körper und die Rätsel des Domingo de Soto," conferencia presentada en el *Internationaler Kongreß – Congresso Internazionale Galileo Galilei* (Berlin 10. -13. Nov. 1994), Actas en prensa, ed. M. Segre).

[34] En el proemio Oresme dice que decidió agregar algunas otras cosas "ut iste tractatus non solum exercitationi prodesset sed etiam discipline" (Clagett [cit. n. 28], 158). Esta disciplina no tiene como único objeto representar geométricamente cualidades y movimientos, sino que pretende explicar ciertos "efectos ocultos" mediante *configurationes*, o también, ofrecer las "causas ocultas" de ciertos efectos. Cf. Parte II, cap. 10, 14, 18, 23, 28, 37; en I, 36 (258) dice "figura effectus". Varios de estos pasajes son analizados por A. Maier, "La doctrine de Nicolas d'Oresme sur les 'configurationes intensionum'," en: *Revue des sciences philosophiques et theologiques* 32 (1948), 51-67. Un despliegue más extenso de esta temática se encuentra en el *De causis miriabilium*, editado, traducido y comentado por Bert Hansen: *Nicole Oresme and the Marvels of Nature. A Study of His "De Causis miriabilium"* (Studies and Texts 68), Toronto/ Ontario, 1985.

Sin poseer la originalidad de los de Buridán u Oresme, los textos de Alberto de Sajonia constituyen por su repercusión posterior un eslabón fundamental en la transmisión de las investigaciones del siglo XIV. Alberto cultivó ambos modos de expresión científica, componiendo *quaestiones* a la *Física* aristotélica y un tratado independiente de gran difusión entre los centros europeos del siglo XVI. En el libro VI de las *quaestiones* lleva a cabo un análisis de la velocidad *tanquam penes effectum*, mientras que en el libro VII –en el contexto de la *regulae* aristotélicas que determinan la velocidad– introduce el estudio *tamquam*

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[35] "Verumtamen quia *extensio est manifestior et palpabilior*, ut ita loquitur, et *prior cognitione quo ad nos quam sit intensio, et forsan quo ad naturam*, ideo non obstantibus predictis ipsa extensio secundum communem usum loquendi atribuitur prime dimensioni, scilicet longitudini, et intensio latitudini" (Clagett [cit. n. 28], 172, énfasis mío).

[36] "Sciendum quod proportio velocitatum arguitur et scitur ex proportione temporum et spatiorum pertransitorum sive acquisitorum, aut aliquorum talium, ut patet sexto et septimo phisicorum. Ex proportione velocitatum arguitur proportio proportionum, et iste processus est a posteriori. Quando, vero, ex proportione proportionum arguitur proportio velocitatum tunc proceditur a causa et a priori" (Grant [cit. n. 21], 286; en la edición de Venecia 1505, fol. l8rab). Grant interpreta el proceso *a posteriori* como un pasaje de la física a la matemática y el proceso *a priori*, a la inversa, como una transición de la matemática a la física (cfr. ibid., 51). Sin embargo, la parte no puramente matemática del texto parece limitarse más bien a un estudio *a priori*. Esto lo distingue no sólo de Bradwardine sino también, de Alberto de Sajonia. Además, la llamada *demonstratio propter quid* no es privativa de la matemática. También ella tiene lugar en la física, cada vez que, en posesión de la causa *eficiente*, se deriva un fenómeno o "efecto", el cuál ya era accesible a los sentidos.

penes causam, asumiendo él también la relación de Bradwardine.[37] Su *Tractatus proportionum* continúa más la línea de Bradwardine que la de Oresme, pues se abre con una introducción matemática sobre el concepto de proporción y luego aborda la medida de la velocidad, primero según las causas –donde se refiere explícitamente a la comparación de las velocidades en *Física* VII– y luego según los efectos –donde menciona la definción aristotélica de "más veloz".[38] Este texto, que alcanzó más de diez ediciones entre 1476 y 1580, circuló además en una versión abreviada por Isidoro de Isolanis, en cuya advertencia preliminar se señalaba la vinculación entre el estudio del movimiento que él ofrecía y los libros VI y VII de la *Física*.[39]

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[37] "Tertio notandum est quod velocitas potest attendi vel cognosci penes aliquid tanquam penes causam vel tanquam penes effectum. Penes causam sicut penes proportionem potentie moventis ad suam resistentiam...Modo autem nolo dicere penes quod attendatur tanquam penes causam, sed de hoc dicetur in septimo. Scilicet modo volo dicere penes quid attenditur tanquam penes effectum" (*Accutissime questiones super libros de physica auscultatione*, Venecia 1516, fol. 66va). Un análisis completo de las *quaestiones* de Alberto a la *Física* como así también indicaciones sobre su influencia posterior se encuentra en J. Sarnowsky, *Die aristotelisch-scholastische Theorie der Bewegung* (Beiträge zur Geschichte der Philosophie und Theologie des Mittelalters, Neue Folge vol. 32), Aschendorff-Münster 1989. El pasaje recién citado fue literalmente copiado por Paulus Venetus en su *Summa naturalium* (cf. Di Liscia, [cit. n. 33]).

[38] Busard (cit. n. 23), 41-72. Según Busard la composición del *Tractatus* (entre 1353 y 1365) es posterior a las *quaestiones* (ibid., 44). Sobre la relación con los tratados de Bradwardine y Oresme anota: "Zu tieferem Verständis der Definition irrationaler und rationaler Verhältnisse scheinen Bradwardine und Albert (im Gegensatz zu Oresme im *Tractatus De proportionibus proportionum*) nicht gekommen zu sein" (*ibid.*). Luego de la introducción matemática (59-62), Alberto comienza el estudio del movimiento así: "His visis videndum est de principali intento scilicet penes quid attenditur proporcio velocitatum in motibus et primo penes quid tanquam penes causam; secundo penes quid tanquam penes effectum" (62). La primer conclusión en el estudio *tanquam penes effectum* es: "velocitas motus localis recti attenditur penes spacium descriptum verum vel ymaginatum in tanto vel in tanto tempore" (68).

[39] Es decir, se señala dónde debe ser insertado el contenido del tratado en un estudio del movimiento (i.e. en la *Física* de Aristóteles): "Cum omnis disciplina naturalis circa motum versetur, quod ignorato necesse quoque est ignorare naturam, tertio physicorum, textu primo, ea propter tractatum sequentem in lucem venire sategimus. Cuius notitia totius sexti phisicorum Aristoteles nec minus ultimi tractatus septimi eiusdem sol est intelligentiae. Adde quod ubi de motu agitur, caeca est omnis consideratio his ignotis quae hic traduntur" (*De velocitate motuum. Fratris Alberti de Saxonia ordinis praedicatorum opus redactum in epitome a fratre Isydoro de Isolanis Mediolanense ordinis praedicatorum*, Lyon

Con todo, es Marsilio de Inghen quien se expresa más directamente sobre los fundamentos metodológicos de la distinción *quo ad causas – quo ad effectus*. En sus *Abbreviationes*, igual que muchos de sus antecesores, entiende las nociones de *notiora nobis* como *effectus* y *notiora naturae* como *causa*, refiriéndose además al problema del razonamiento circular y a los procesos *quia* y *propter quid*.[40] En el libro VI introduce la distinción entre ambos enfoques de la velocidad, explicando a propósito porqué es preciso comenzar *quo ad effectus*: el movimiento puede ser estudiado según la proporción de la fuerza motriz a la resistencia o según el espacio recorrido; en tanto aquéllas representan las causas del movimiento, éste se comporta como su efecto, pues es "a nobis sensibile seu perceptibile".[41]

Esta afirmación reúne, por tanto, la identificación de *notiora nobis* con *effectus* y, a la vez, la extendida convicción de que la velocidad del movimiento local es medida según el espacio recorrido. Para que esta conexión fuera posible, los parisinos habían además establecido, dentro de sus cuestiones a la *Física*, una serie de condiciones relativas al concepto de *mensura*. Una de ellas exigía que la *mensura* sea más conocida (*commune* y *famosa*) que lo medido; con lo cual, cualquier cosa que ella fuera, sería en cierta forma asimilable a un *effectus*.[42]

1580). Este "epitome" está dividido en 16 capítulos de los cuales los 6 primeros son matemáticos y los restantes estudian el movimiento *quo ad causas* y *quo ad effectus*. Pero no todo es resumen: en el proemio, al explicar la "proportio transumptive", ejemplifica "ut materiae ad formam, potentiae ad obiectum et omnis causae ad effectum" (5). Además, agrega un capítulo sobre un tema que no aparece en el original de Alberto publicado por Busard: de proportione diametri ad costam (5-6).

[40] *Abbreviationes libri physicorum*, Venecia 1521, fol. 2ra-3va.

[41] "Scias quod duo circunstant et concurrunt ad velocitatem, scilicet proportio potentie moventis supra resistentiam, quia quanto hec fuerit maior tanto sit motus velocior, et spacium pretransitum per motum, quod quanto fuerit maior tanto motus est velocior. Quorum primam habet se ut causa, secundam ut effectus. Motus enim sequitur proportionem sicut effectus suam causam" (ibid., fol. 27rb). Marsilio destaca además que en el movimiento de los cuerpos celestes no habría resistencia pero sí espacio recorrido; con lo cual éste será siempre un punto de partida más seguro y más general que la proporción entre fuerzas y resistencias: "Orbes enim celestes non resistunt ut dicetur in secundo celi; spatium autem ad omnem motum concurrit saltem a nobis sensibilem seu perceptibilem"(*ibid.*)

[42] Esta condición de la *mensura*, desarrollada por teóricos parisinos del ímpetus en sus cuestiones en torno al estudio aristotélico del tiempo, se remontaría a Averroes (J. Sarnovsky, "Zur Messung von Zeit und Bewegung: Einige spätscholastische Kommentare zum Ende des vierten Buchs der aristotelischen Physik," en: A.

Siguiendo la línea de razonamiento de Marsilio de Inghen, el autor de las *Quaestiones secundum nominalium viam*, Johannis Marcilius [sic] de Inghen,[43] se refiere primero en general a qué significa considerar o medir (*attenditur*) la velocidad con respecto a algo, luego con respecto al movimiento local recto y finalmente con relación al movimiento circular. Después de mencionar la definición aristotélica de "más veloz", Johannes Marcilius advierte que "velocitatem motus attendi penes aliquid non est aliud quod scire illud quid est per quod possumus cognoscere unum esse velocius quod reliquo".[44] Para poder establecer una medida, ella debe cumplir ciertos requisitos: *notum, invariabile* e *immobile*. Ahora bien, en el estudio de la velocidad es preciso comenzar *quo ad effectus* pues éstos son *nobis notius* y el espacio es *"quasi effectus"*:

> Item notandum quod duo concurrunt ad velocitationem <velocitatem!> motus, per quorum quodlibet potest cognosci quanta est velocitas, scilicet proportio potentie motoris ad resitentiam moti, et qualiter penes hoc attendatur velocitas, dictum fuit super quarto. Secundo concurrit spacium pertransitum a mobili. Et *magis proprie* attenditur velocitas *penes spacium* descriptum a mobili quam proportionem potentie ad resistentiam. Primo quia *illud spacium est nobis notius*, sed proportio potentie ad resistentiam non cognoscitur nisi arguitive et ex consequenti, eo quod talis proportio non sentitur. Secundo, quia spacium ponitur in definitione velocioris, et ideo spacium videtur magis de intrinsecitate <intensione?> velocitatis quam proportio potentie ad resistentiam. Tertio quia huiusmodi *proportio potentie ad resistentiam est causa velocitatis, sed spacium pertransitum est quasi effectus. Modo in naturalibus effectus sunt nobis*

Zimmermann (ed.), *Mensura, Maß, Zahl, Zahlensymbolik im Mittelalter*, [Miscellanea Mediaevalia 17], vol. 1, Berlin/New York 1985, 254-73).

[43] *Questiones subtilissime Johannis Marcilii Inghen super octo libros physicorum secundum nominalium viam*, Lyon 1518, Reprint: Frankfurt 1964. La atribución a Marsilio de Inghen de este texto es todavía insegura (ver la introducción de E. P. Bos a *Marsilius of Inghen: Treatises on the Properties of Terms. A First Critical Edition of the "Suppositiones, Ampliationes, Appellationes, Restrictiones and Alienationes"*, Dordrecht/Boston/Lancaster 1983, 14-5 y la bibliografía por él citada). Sin tomar partido en la cuestión de la atribución me referiré neutralmente al autor de este texto –diferenciándolo de Marsilio de Inghen, autor de las *Abbreviationes*– como "Johannes Marcilius".

[44] Ibid., fol. 68rb. Comentando la definición aristotélica de "más veloz" (cfr. n. 1) Johannes Marcilius subraya enseguida el papel del espacio: "per consequens penes huiusmodi spacium est attendenda velocitas" (ibid., fol. 68ra). Aunque este trabajo se limita al movimiento local conviene advertir que Johannes Marsilius admite aquí un empleo "transumptive" del término "*spatium*" según el cual él comprendería la "distantia terminorum" que se verifica en todo movimiento, local, cuantitativo o cualitativo.

> *notiores suis causis; ideo potius devenimus in noticiam velocitatis per spacium quam per proportionem potentie ad resistentiam.*[45]

Esta mutua transferencia conceptual entre la tradición mertonense en el estudio de la velocidad y el texto de la *Física* aristotélica, que posibilitaba la comprensión del espacio como *effectus*, no sólo no se interrumpió durante los dos siglos siguientes sino que incluso se intensificó con la edición de varios tratados mertonenses y con la composición de nuevos comentarios y *quaestiones* a la *Física* aristotélica.

En lo que sigue, y sin pretender ser exhaustivo, intentaré presentar un aspecto de este complejo proceso histórico, siguiendo el hilo conductor de la distinción *quo ad causas* y *quo ad effectus* y tomando como término final a Domingo de Soto, cuyo punto de vista resulta interesante comparar y a la vez parcialmente diferenciar de los demás autores aquí tratados.

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A este fin, será adecuado organizar la exposición a partir de los dos textos pertenecientes a la escuela mertonense que más influyeron en el desarrollo posterior hasta el siglo XVI. Se trata del *Liber calculationum* de Richard Swineshead y de las *Regule Solvendi sophismata* de Heytesbury.

Además de ser bien conocido en Italia y Francia, el primero parece haber despertado bastante interés en la península Ibérica, donde dió lugar a varios estudios que continuaban la tradición de los calculadores. El más famoso de ellos –quizás por su tecnicismo en el manejo de las *calculationes*– fue el *Liber de triplici motu* del portugués Alvaro Thomaz[46]. Respetando una estructura más o menos standard que proviene de Bradwardine, Alvaro antepone un breve proemio y un primer extenso capítulo *de proportione* antes de comenzar el estudio del movimiento, primero *quo ad causas* y depués *quo ad effectus*. Así, él mantiene el orden que había propuesto el Calculator, sólo que, cuando menciona la distinción misma no se apoya en él (pues, como hemos visto antes la distinción no estaba disponible en el *Liber calculationum*) sino en los textos metodológicos de Aristóteles. Esto lo conduce a asociar expresamente la *scientia a priori* y la demostración *propter quid* con el enfoque causal y la demostración *quia* con el análisis *quo ad effectus*.[47] En

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[45] Ibid., fol. 68rb, énfasis mío. Aunque este pasaje es, como muchos otros, muy cercano a las *Abbreviationes* de Marsilio, no contiene la referencia a los movimientos celestes (cfr. n. 36). He retocado la puntuación del original y corregido entre <> en dos oportunidades. El caso de "velocitatio" es importante, pues este término significaría variación de velocidad (i.e. aceleración). En el contexto es claro, no obstante, que se trata de "velocitas". M. Clagett cita el pasaje correspondiente a éste por la edición posterior de las obras de Duns Scoto (Lyon 1639) en el marco de su interpretación de *quo ad effectus* y *quo ad causas* como anticipación de cinemática y dinámica (Clagett [cit. n. 19], 209). La referencia al libro IV es probablemente con respecto a la quaestio 11: utrum velocitas motus sequatur proportionem potentie motoris ad resistentiam moti... (fols. 53ra-54rb). Sin embargo, Johannes Marcilius trata la velocidad *quo ad causas* en las quaestiones 6 y 7 del libro VII (fols. 77ra-79ra).

[46] *Liber de triplici motu proportionibus annexis magistri Alvari Thome Ulixbonensis philosophicas Suiseth calculationes ex parte declarans*, Paris 1509. Murdoch y

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Sylla han trazado las líneas generales de influencia del *Liber calculationum* en "Swineshead, Richard" (cit. n. 26), 209-11. Sobre los desarrollos en París y España –que podrían ser tomados en parte como un mismo bloque–, los autores mencionan los textos físicos de Juan Dullaert Gandavus, Juan de Celaya, Luis Coronel y Diego de Astudillo, como seguidores de Alvaro Thomaz al incorporar "calculatory material" en sus *quaestiones*. En lo que se refiere a la suerte de Swineshead en España, se podrían agregar todavía dos textos: Una edición del *Liber calculationum* por Juan Martínez Silíceo (Murdoch y Sylla, ibid., 211 mencionan ediciones del *Liber calculationum* en Padua, ca. 1477; Pavia 1498 y Venecia 1520): *Calculatoris Suisseth anglici sublime et prope divinum opus... cura et diligentia philosophi Silicei*, Salamanca 1520 y un comentario de Alfonso de Prado, Comentario a Suisseth, el Calculator, s.d. Según Muñoz Delgado, Alfonso de Prado habría declarado haber compuesto este obra en sus *Quaestiones dialecticae super Peri Hermeneias* (Alcalá 1530 f. 21r). Para éste y otros textos españoles vinculados a la tradición de los calculadores ver V. Muñoz Delgado, "Ciencia y filosofía de la naturaleza en la Península Ibérica (1450-1600)," *Repertorio de las ciencias eclesiásticas en España VII*, Salamanca 1967-1979, 67-148; también W. A. Wallace, "The 'Calculatores' in Early Sixteenth-Century Physics," en: *The British Journal for the History of Science* 4 (1969), 221-32, idem, "Mechanics fron Bradwardine to Galileo," en: *Journal of the History of Ideas* 32 (1971), 15-28. Para la tradición mertonense en Italia Ch. Lewis, *The Merton Tradition and Kinematics in Late Sixteenth and Early Seventeenth Century Italy*, Padua 1980 (cfr. especialmente 126-70 sobre Buonamico).

[47] "Sequitur tractatus secundus huius tertie partis in quo determinatur de velocitate et tarditate motus penes effectum, exordiendo primo a motu locali tanquam a priori. Capitulum primum in quod ponuntur aliqua communia elementa in hac materia definitiones videlicet divisionibus adiunctis. Philosophorum principis Aristotelis plerisque in locis sue philosophie huic nostro mutio apprime accomoda extat sententia. Ait enim prohemio *Physicorum* et in principio moralis philosophie inducendo Platonis testimonium, duplicem rerum cognoscendi esse viam, a priori videlicet et per causas usque ad elementa resolvendo, et per effectum, quos duos cognoscendi tramites primo *Posteriorum* capite illo in quo demostrationem ipsam partitur, quia et propter quid apellat, suapte tamen natura intellectui nostro ut eidem Philosopho placet preallegato prohemio innata atque congenita est via per effectum rem dinoscendi, tam et si utroque tramite ipsarum rerum cognitionem attingere valeat. Exacta igitur atque tradita ut potuimus velocitatis et tarditatis motus noticia penes primum modum, propter quid videlicet et per causam que

otro pasaje todavía, retoma la conexión que encontramos en el *Tractatus de proportionibus proportionum* de Oresme entre el estudio *quo ad effectus* y la *scientia a posteriori*, conectando ambos con la medida de la velocidad según el espacio recorrido.[48]

Por otra parte, tal conexión entre el doble enfoque en el análisis del movimiento y estos conceptos metodológicos estaba ya disponible no sólo en los comentarios a la *Física* del siglo XIV antes mencionados, sino que había sido incorporada también en la edición de las *Regule* de Heytesbury de 1494, comentadas por Gaetano da Thiene y otros autores.[49]

Se trata del ámbito liderado en primer lugar por Blas Pelacani de Parma y luego por Paulus Venetus. Continuando con el modo de proceder usual en algunos autores de la tradición parisina, como Oresme y Alberto de Sajonia, Blas retoma el problema de la medición de la velocidad en un comentario al tratado de Bradwardine y en sus *quaestiones* a la *Física* de Aristóteles. Es una cuestión discutida cuál es en realidad la posición de Blas con respecto a la "ley de Bradwardine". Como quiera que sea, parece

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causa proportionalitas geometrica est, ima nunc presens opus nos inducit atque admonet ad tradendam noticiam velocitatis et tarditatis motus penes secundum modum cognoscendi, hoc est penes effectum" (fol. n.1vb). Sobre Alvaro Thomaz ver E. D. Sylla, "Alvarus Thomas and the Role of Logic and Calculations in Sixteenth Century Natural Philosophy," en: S. Caroti (ed.), *Studies in Medieval Natural Philosophy* (Biblioteca di Nuncius, Studi e Testi 1), Firenze 1989, 257-98 (este pasaje en 268, n. 31), M. Clagett (cit. n. 28), 496, y E. Grant (cit. n. 31), 70-1.

[48] "Notandum est quarto ut superius tactum est velociates motuum dupliciter investigari posse, videlicet ex commensuratione spaciorum pertransitorum et hoc ab effectu et a posteriori..." (ibid., fol. p3vb; ver Sylla, 290). Alvaro menciona el tratado de Oresme en fol. p4vb (Sylla, 291).

[49] *Regule solvendi sophismata*, Venecia 1494; editadas junto con otros textos de Heytesbury –algunos de atribución espuria– y comentarios de Gaetano da Thiene, Messino, Angelo de Fossambruno, Bernardo Torni y, sobre los *sophismata* conjutamente impresos, de Simón de Lendenaria (cf. C. Wilson, *William Heytesbury. Medieval Logic and the Rise of Mathematical Physics*, Madison 1956). Alvaro dice: "Videas Hentisberus cum commentatore suo [Gaetano da Thiene] in tractatu de motu locali"(fol. x2vb; cf. Duhem, *Études sur Léonard de Vinci*, Paris 1908, vol. 3, 535). Las *Regule* de Heytesbury fueron impresas en Pavia (1481, probablemente también 1483), Venecia 1481 y la antes citada edición, aparentemente la más divulgada, de Venecia 1494. Para la recepción de Heytesbury en Italia (especialmente en Bologna) con una amplia base documental *cfr.* D. Buzzetti, "Linguagio e ontologia nei commenti di autore bolognese al *De tribus praedicamentis* di William Heytesbury," en: D. Buzzetti, M. Ferriani, y A. Tabarroni (eds.), *L'insegnamento della logica a Bologna nel XIV secolo*, Bologna 1992, 579-604.

claro que Blas quiere ser crítico sin que ello, no obstante, le impida introducir tanto en su comentario a Bradwardine como en *Física* VII la formulación *quo ad causas – quo ad effectus* y reafirmar la identidad entre *notiora nobis*, *effectus* y *spatium pertransitum*.[50]

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[50] Contra la opinión general, E. Grant opina que Blas de Parma habría aceptado la ley de Bradwardine ("Blasius of Parma," en: *Dictionary of Scienitifc Biography* (cit. n. 26), vol. 2, 192-5, ver además n. 28). En general sobre Blas de Parma ver G. Federici Vescovini, *Astrologia e scienza. La crisi dell'aristotelismo sul cadere del Trecento e Biagio Pelacani da Parma*, Firenze 1979, sobre este asunto 274-6; 354-63). Para un estudio más exhaustivo del problema, cfr. A. Harrison, "Blasius of Parma's Critique of Bradwardine's 'Tractatus de Proportionibus'," en: A. Poppi (ed.), *Scienza e filosofia all'università di Padova nel Quattrocento*, Padova 1983, 19-69.

El comentario de Blas Pelacani sobre Bradwardine conservado en Ms. Vat. lat. 3012, ff. 137r-163r contiene 12 cuestiones. En la cuestión 10 Blas investiga "*utrum potentia velocitatis insequatur proportionem potentiarum motivarum ad eorum resistentias, ut effectus causam*" (fol. 149v). Al menos en esta formulación (difícil reconocible en la transcripción de Harrison, 41, n. 60) Blas sigue el planteo del *De proportionibus* de Oresme (cfr. n. 36 y mi comentario): si tomamos una determinada relación entre fuerzas y resistencias como causas del movimiento, entonces se sigue la velocidad como si fuera su efecto, en el sentido que ella es producida por y su magnitud depende de aquella relación entre los factores causales. Discutiendo la acción de las cualidades, Blas establece que podemos entender la expresión "la velocidad se sigue según tal y tal proporción" (velocitas insequitur proportionem tallem vel tallem) de dos formas: a) como "accelleratio", por lo cual Blas aparentemente entiende la *variación intensiva* introducida por el agente en el paciente, la cual "non potest bene intelligere sine tempore" (*ibid.*) y b) como "el *efecto* producido o producible por el agente en el paciente" (alio modo per velocitatem possumus intelligere effectum productum agentis vel producabilem in passum". (Harrison, 44; 45 n. 68). Por otra parte, en sus *questiones disputate super octo libros physicorum* (Ms. Vat. lat. 2159, ff. 61r-225r) Blas distingue el método de medición en el movimiento cualitativo y en el movimiento local de la siguiente manera: "Queritur ultimo quia velocitas in motu locali non dicitur esse penes latitudinem in tanto tempore acquisitam aut penes gradum velocitatis, sicut dicitur de motu alterationis. Respondetur quod causa est quia *spatium pertransitum in motu locali est nobis notius* quam sit latitudo motus aut gradus velocitatis"(f. 204r, énfasis mío. Citado en A. Harrison, 56 n. 90. Harrison remite oportunamente al párrafo antes citado de Johanes Marcilius; en Clagett (cit. n. 19), 209, n. 29 como "Marsilius of Inghen"). Conviene destacar que la distinción *quo ad causas – quo ad effectus* no se encuentra como tal en Bradwardine (como dice A. Harrison, 33), sino que se trata de una reelaboración posterior ya disponible antes en varios textos antes de Blas Pelacani. Entre ellos –como hemos visto– también en los tratados corespondientes sobre las proporciones de Oresme y Alberto de Sajonia, que Blas conoce y quiere criticar: "et in eiusdem errorem [en no saber distinguir, lo mismo que Bradwardine, entre "partes componentes" y "partes producentes"] cecidit magister Albertus de

En sus *Recollecte* sobre la *Física* de Aristóteles, Gaetano da Thiene expone la *via doctrinae* siguiendo los tres tipos de demostración –*demostratio signi, causae* y *simpliter*– de Averroes.[51] Aquí, como al comentar enseguida el texto inicial de *Física* I, 1, 184a, hace extenso uso de la noción de "*effectus*" para exponer *notiora nobis* y repite los cuatro modos de comprender *notiora naturae* propuestos por Paulus Venetus.[52] El hecho de que Gaetano no aplique la doble distinción en el análisis de la velocidad ni en *Física* VI ni en VII –como, por lo demás, ya lo había hecho su maestro Paulus Venetus– puede tal vez explicarse por su detalladas glosas a las *Regule* de Heytesbury. Mientras que Paulus Venetus parece seguir a Alberto de Sajonia tratando la velocidad primero *quo ad causas* y luego *quo ad effectus*, Gaetano introduce inmediatamente en su comentario de las *Regule* la distinción –que Heytesbury mismo no había hecho– entre ambos enfoques en el estudio de las *passiones* y *proprietates* del movimiento, i.e. de las distintas formas de velocidad, incorporando además al texto mertonense la asociación con la *scientia a priori* (según las causas) y la *scientia a posteriori* (según los efectos).[53]

Saxonia in suo tractatu. Similiter magister Nicholaus Orem in textu suo de proportionibus proportionum" (Vat. Lat. 3012, fol. 144va).

[51] "Sexto manifestat Commentator vias huius doctrine et dicit quod sunt tres modi demonstrationis qui usitantur in doctrinis, scilicet demonstratio signi, demonstratio cause et demonstratio simpliciter. Et per demonstratio signi intelligit illam que est ab effectu ad causam. Effectus enim significat suam causam similitudinem eius quodam modo gerendo. Per demonstrationem cause intelligit illam que est a causa ad effectum suum, dummodo non sit potissima. Per demonstrationem autem simpliciter intelligit demonstrationem potissiman cuius medium aggregat omnia genera causarum illius quam demonstrat, et saltem illam cuius premisse sunt in illa scientia indemonstrabiles et forte intelligit aliter ut post apparebit" (*Recollecte super octo libros phisicorum Aristotelis*, Venecia 1496, sin número de folio. Contando el primero desde el comienzo "saepe animadverti insignes..." el texto citado corresponde a fol. 1v).

[52] A saber: a) quod per prius intendit natura; b)quod secundum naturam suam est maioris entitatis et magis cognoscible; c) quod potest cognosci sine alio et non econtra; d) a quo natura incipit operari (*Recollecte*, fol. 5 rb) Cf. Paulus Venetus, *Summa philosophiae naturalis*, Paris 1514, fol. 3rb. Para algunas consideraciones generales sobre ambos autores cf. F. Bottin, "Logica e filosofia naturale nelle opere di Paolo Veneto" y "Gaetano da Thiene e i 'Calculatores'," en: *Poppi* (ed.) (cit. n. 50), 85-124 y 125-34 respectivamente.

[53] Cf. Paulus Venetus comienza por las causas (como Alberto de Sajonia en su *Tractatus proportionum*), pero el pasaje introductorio es literalmente idéntico a las cuestiones de Alberto, quien por el contrario comienza aquí con los efectos (cfr.

Una más explícita vinculación entre ambos modos de tratar la velocidad y los correspondientes procedimientos metodológicos se halla todavía en el breve comentario de Angelo de Fossambruno al capítulo de las *Regule* sobre el movimiento. Angelo conecta el enfoque *penes causam* con la *scientia a priori* y el proceso demostrativo *propter quid*, y el enfoque *quo ad effectum* con la *scientia a posteriori* y el proceso *quia.*[54]

Al comenzar el siglo XVI se disponía, por tanto, de un conjunto de referencias cruzadas entre textos mertonenses que incorporaban referencias a la metodologías aristotélica y comentarios a la *Física* del siglo XIV que incluían la distinción *quo ad causas* y *quo ad effectus* en el estudio cuantitativo del movimiento.

Esta última dirección fue todavía profundizada por Juan Maior y sus seguidores mediatos o inmediatos de París y de las universidades españolas[55]. Maior y varios de sus discípulos dieron tanto lugar a los

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Paulus Venetus [cit. n. 52], fol. 46va-b y Alberto de Sajonia, *questiones physicorum* [cit. n. 37], fol. 66v. Cfr. pasajes en Di Liscia [cit. n. 33]). Heytesbury se había ceñido al análisis que la historiografía ha dado en llamar "cinemático" y que correspondería aquí al estudio *quo ad effectus* (Wilson, [cit. n. 49], 115). Sin embargo, Gaetano comenta el comienzo de las *Regule* así: "Et duplex sit scientia de his passionibus motus seu proprietatibus scilicet a priori et a posteriori. A priori est quondam ille passiones insequuntur proportionem motoris ad motum sit velocitas et tarditas motus. Secundo vero sit scientia de istis proprietatibus et non a priori sed a posteriori scilicet quo ad effectum in equali tempore, quia mobilia esse mota motu augmentationis velocius vel tardius et sic in principio huius prime partis velocitas et tarditas motus attenditur penes effectum et terminum acquisitum in equali tempore" (*Declaratio super tractatu Henstiberi regularum...*, Venecia 1949, fol. 37rab).

[54] "In istis igitur tribus praedicamentis per se et proprie reperitur motus, scilicet quantitatis qualitatis et ubi. De uno quoque igitur talium motuum dicendum est penes quid uniuscuiusque istorum velocitas attendi habet et cognosci. Cognosci autem habet velocitas motus sicut etiam quecunque res nostre cognitioni subiicibilis duplici modo cognoscendi, scilicet a priori et a posteriori, vel penes causam vel effectum; et hi modi duplici processui correspondent, scilicet quia et propter quid in omnibus. Igitur de motibus a priori aut penes causam velocitas eodem methodo cognosci potest" (Angelus Forsempronensis, *Super tractatu de motu locali [Hentisberi]*, Venecia 1494, fol. 64rb). Sobre este texto de Angelo de Fossambruno cfr. G. F. Vescovini, *"Arti" e filosofia nel secolo XIV. Studi sulla tradizione aristotelica e i "moderni"*, Firenze 1983, 59-75.

[55] Para una presentación general de los estudios parisinos en torno de Maior, sus antecesores y seguidores, siguen siendo de utilidad H. Élie, "Quelques maîtres de l'université de Paris vers l'an 1500," en: *Archives d'histoire doctrinale et littéraire du moyen age* 18 (1950-1951), 193-243 y R. García Villoslada, "La Universidad de París durante los estudios de Francisco de Vitoria, O.P. (1507-1522)," en: *Analecta Gregoriana* 14 (1938), 127-64. Ver también W. A. Wallace, "Maior,

métodos, puntos de vistas y conceptos particulares elaborados por los mertoneses que la estructura de la *Física* de Aristóteles se alteró de tal modo que apenas respetaba la antigua división en libros y capítulos, convirtiéndose en el marco de exposición y legitimación de puntos de vistas que excedían los contenidos del texto original mismo. En su estudio sobre la *Física* aristotélica, Maior incluye largos pasajes en los que acusa una gran familiaridad con los textos de los calculadores. En el libro VII identifica las reglas aristotélicas sobre la velocidad del movimiento local con el análisis *quo ad causas*, razón por la cual considera conveniente incorporar además el análisis *quo ad effectus*, omitido –en su opinión– por Aristóteles.[56]

Los discípulos de Maior que continuaron el proceso de incorporación de *sophismata* y *calculationes*, siguieron haciéndolo de hecho en torno del texto aristotélico; no ya únicamente en *commentaria* y ni siquiera en *quaestiones* sino, en trabajos por así llamarles "mixtos", en cuyos títulos la palabra "física" puede estar haciendo referencia a la disciplina misma y a un cuerpo de problemas que exceden el texto de "la *Física*" de Aristóteles.

El joven teólogo Jacobo Almain compuso además de trabajos teológicos y morales unos *Embammata phisicalia*, que han sido desatendidos por los historiadores modernos pero que, sin embargo, no carecen de interés tanto por su contenido como por la forma de exposición.[57] Antes que exponer el texto de la *Física*, que resulta aquí

John," en: *Dictionary of Scientific Biography* (cit. n. 26), vol. 9, 32-3. Para la lógica de Maior y sus discípulos escoceses Cranston, Lokert, Caubraith y Manderston, ver A. Broadie, *The Circle of John Mair. Logic and Logicians in Pre-Reformation Scotland*, Oxford 1985.

[56] "Et quia Aristoteles in hoc septimo ponit regulas de velocitate motus localis quo ad causam, quaeremus etiam de velociate motus localis quo ad effectum" (*Octo libri physicorum cum naturali philosophia atque metaphysica Johannis Maioris Hadigtonani theologie parisiensis*, Paris 1526; L. VII, de velocitate motus localis recti penes quid attenditur; fol. i1vb).

[57] *Embammata phisicalia magistri Jacobi Almain senonensis*, Paris 1505. El texto no es mencionado por Élie (cit. n. 55) pero sí por García Villoslada (cit. n. 55), 167, y Lohr, "Renaissance Latin Aristotle Commentaries: Authors A-B," en: *Studies in the Renaissance* 21 (1974), 242. Discutiendo *maxima et minima* "in ordine ad Deum", se lee en los llamados *Juvenilia* de Galileo: "At vero Capreolus in 3° distint. 13 q. et p.° dist. 17 q. 4, Almainus et Gregorius ibidem..." (*Le Opere di Galileo Galilei*, ed. Favaro, Firenze 1890, I, 146). Wallace lo identifica con nuestro autor refiriéndose a su comentario sobre las *Sentencias* publicado en París 1512 (W. A. Wallace, *Galileo's Early Notebooks: The Physical Questions. A*

difícilmente reconocible, Almain intercala en los libros I y III –no sin anteponer un proemio "de proportione et proportionalitate"– un conjunto de dificultades provenientes de los tratados mertonenses, tratando a Aristóteles como un autor más junto a un selecto espectro de calculadores y comentadores de Aristóteles. De hecho, aunque sin fundamentarla metodológicamente, Almain emplea la distinción *quo ad causas – quo ad effectus*, identificando expresamente los efectos del movimiento local con el espacio recorrido.[58]

Entre los varios discípulos de Maior se cuentan también españoles como los hermanos Nuñez Coronel. Antonio, tal vez el alumno favorito de Maior, compuso un texto de lógica, en el cual pretende haber incluído ciertas "calculationes", y probablemente también uno de física[59]. Por su parte, Luis Coronel escribió sobre lógica y física. En sus *Physice perscrutationes*[60], menciona asiduamente los autores de la tradición

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Translation from the Latin, with Historical and Paleographical Commentary, Notre Dame/London 1977, 210). Hasta donde sé los *Embammata* no han recibido todavía ningún estudio detallado.
Charles Lohr agrega un Ms. de Sevilla, Bibl. Colombina 7-6-12 en su *Aristotle Commentaries II: Renaissance Authors*, Firenze 1988).

[58] "Pro velocitate motus localis cognoscenda. Penes effectum puta spacium pertransitum" (fol. 51ra). Almain menciona a Gregorio da Rímini y Ockham; Heytesbury, Swineshead y Burley; Buridán, Oresme, Alberto de Sajonia, y Marsilio de Inghen; Paulus Venetus, Jacobo de Forli y Pedro Mantuano. Para el estudio del infinito remite a "venerandus preceptor meus magister Johannes Maioris" (fol. 111va). El libro I plantea "dificultates" relativas a la distinción entre cantidad y "cosa cuantificada" y a *minima et maxima*, omitiendo toda discusión sobre *notiora nobis* y *notiora naturae* u otras consideraciones metodológicas.

[59] Hasta yo sé, nadie ha reportado la existencia de un texto físico de Antonio Coronel (cf. Muñoz Delgado (cit. n. 30); C. H. Lohr, "Renaissance Aristotle Commentaries: Authors C," en: *Renaissance Quarterly* 28 (1975), 723). Sin embargo, parece haberlo compuesto: "Effectus enim aliquando notiores sunt quo ad naturam. Sed de ordine cognitionis inter causam et effectum ad longum satis diximus in prohemio phisicorum" (*Magistri Antonii Coronel Segobiensis in posteriora Aristotelis commentaria*, Paris 1510, fol. 60r) Al final del texto, Antonio dice haber empleado "quaedam calculatio" (fol. 76vb). De hecho lo hace frecuentemente. Al exponer las relaciones entre el "assensus conclusionis" con la menor, la mayor y la consecuencia dice "hec propositio supponitur in presenti que faciliter potest probari *per regulam calculatoriam de difformibus uniformiter*" (fol. 11va, énfasis mío).

[60] *Physice perscrutationes*, Lyon 1512. Lohr (cit. n. 59), 724, menciona ediciones de París, posterior a 1511; Lyon 1530 y Alcalá 1539. Cf. también W. A. Wallace "Coronel, Luis Nuñez," en: *Dictionary of Scientific Biography* (cit. n. 26), vol 3, 420-1.

mertonense y parisina, interpolando extensas exposiciones sobre el movimiento y el infinito, y empleando frecuentemente "*exempla*" para facilitar la comprensión de las cuestiones discutidas. Estudiando la velocidad según el orden "*de triplici motu*" (muy probablemente por tanto a partir de Heytesbury y quizás también siguiendo a Alvaro Thomaz), explica "*succincte*" qué significa medir la velocidad del movimiento antes de introducir la distinción *quo ad causas* y *quo ad effectus*. Luego, se refiere a cada una de las partes –ofreciendo un ejemplo de cada caso– y menciona la similitud entre efecto y espacio recorrido. Finalmente, observa que "como suele hacerse" se ocupará primero del movimiento local según los efectos.[61]

Domingo de Soto pertenece al numeroso grupo de filósofos ibéricos que estudiaron en París bajo el influjo directo o indirecto de Maior. A causa de su urgente convocatoria para el Concilio de Trento publicó en 1545, sin concluirlos, sus comentarios y cuestiones a la *Física* de Aristóteles. A su regreso completó los libros faltantes y los entregó nuevamente a la imprenta, alcanzando varias ediciones españolas y una edición veneciana en 1582.[62]

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[61] "De triplici motu consideratione habita penes quid cuiuscunque eorum attendatur velocitas; differendum ocurrit breviter admodum et succincte in huiusmodi perscrutatione procedimus, quia inutile in talibus immorari reputo.
Advertendum primo est quod inquirere penes quid velocitas motus debeat attendi nihil aliud est quod investigare ad quid respicere debemus vel secundum que [sic] debet fieri ad recte iudicandum unum motum velociorem vel tardiorem esse alio vel eque velocem...Secundum sciendum est quod communis stat sententia velocitatem motus attendi posse penes aliquid tanquam penes effectum vel penes aliquid tanquam penes motivam potentiam. Hoc est clarius dicere quod ad recte iudicandum an duo motus eque veloces fuerint vel in qua proportione unus alium excedit in velocitate contingit respicere ad effectus a talibus motibus productos et illos inter se comparari vel ad motivas potentias et secundum illas facere comparatione. Exemplum primi iam positum est ubi est attendendum quod pertransitio spacii effectus reputatur, quamvis nihil producatur. Exemplum secundi potentia motiva a/ fuisset ut 4 et sua resistentia ut ... Et de velocitate motus localis ut communiter fieri solet primo pertractandum est, ostendendo penes quid tanquam penes effectum debeat velocitas motus localis attendi" (ibid., fol. 84vb-85ra).

[62] *Super octo libros physicorum subtilissimae quaestiones / Super octo libros physicorum praeclarissima commentaria*, Venecia 1582. Una biografía completa con un catálogo de las obras de Soto se encuentra en V. Beltrán de Heredia, *Domingo de Soto: Estudio biográfico documentado*, Madrid 1961. Ver también W. A. Wallace, "Soto, Domingo de," en: *Dictionary of National Biography* (cit. n. 26), vol. 12, 547-8. Para una amplia bibliografía sobre los distintos aspectos del

En sus *commentaria,* Soto se ciñe al texto aristotélico según la antigua división en capítulos a los que, por lo demás, titula según el contenido. Autor él mismo de textos de lógica, en los que no se excluyen problemas de filosofía natural, Soto menciona en el prefacio de su comentario a la *Física* la distinción entre *demonstratio a signo, propter quid* y *simpliciter.*[63] No obstante, él no traslada en los *commentaria* estos conceptos metodológicos al tratamiento de la velocidad, posiblemente porque no ha estructurado aquí su estudio a partir de la distinción entre *quo ad causas* y *quo ad effectus.*

Este punto de vista, sin embargo, domina el análisis de la velocidad en las *quaestiones*, donde el autor puede liberarse de la mera explicación del texto aristotélico. Las cuestiones 2, 3 y 4 del libro VII pueden ser comprendidas como un mismo bloque, y ciertamente en referencia al *Tractatus proportionum* de Alberto de Sajonia. Luego de una introducción aporética en la cuestión 2 sobre el problema de la comparabilidad entre distintos movimientos, Soto interpola una *disgressio de proportionibus* en la que sigue y amplía los conceptos centrales de la primera parte del tratado de Alberto. Sobre la base de esta exposición, aborda sucesivamente el estudio *quo ad effectus* y *quo ad causas*, lo que corresponde inversamente al tratado de Alberto. Si Domingo de Soto, por tanto, ha incorporado lo esencial del tratado de Alberto de Sajonia a sus *quaestiones* –lo que por sí mismo merecería un estudio más detallado que éste–, lo ha hecho disponiendo las partes según el orden metodológico “correcto”: mientras Alberto comenzaba por las causas y seguía por los efectos, Soto lo hace a la inversa.[64] Con ello, Domingo de Soto está lejos de ser original, pues ya hemos visto como varios autores antes que él se habían decidido a comenzar *quo ad effectus*. Sin embargo, la razón que Soto ofrece para tal proceder es digna de atención:

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pensamiento de Soto ver Ch. H. Lohr, “Renaissance Aristotle Commentaries: Authors So-Z,” en: *Renaissance Quarterly* 35 (1982), 167-70.

[63] Igual que Paulus Venetus y Gaetano da Thiene, dice seguir a Averroes (cfr. *Commentaria* [cit. n. 62], 5).

[64] De acuerdo con la edición citada, el orden es: q. 2: utrum motus quicunque cuicunque alii motui sit comparabilis (325B-336F). Esta *questio* 2 incluye la extensa *disgressio de proportionibus* (328F-336F); q. 3: utrum velocitas motus ab effectu attendatur penes quantitatem spatii, quod pertransitur (336F-344D); q. 4: utrum velocitas motus attendatur ex parte causae penes proportionem proportionum, quae sunt velocitatum ad suas ipsarum resistentias (344E-350A).

> Circa titulum quaestionis, quam in duos partimur articulos, adnotandum est, quod cum dua sint viae cognoscendi rem aliquam, quas in prologo huius adnotavit Aristoteles. Prima *quo ad nos per effectum*, quod est nosse *quia est*; id est hoc est hoc, ut videntes ridere hominem, cognoscimus esse risibilem. Et secunda ordine naturae *per causam*, quod est cognoscere *propter quod*, in quo proprie consistit ratio scientiae. Praesenti quaestione scrutamur viam ex effectu, tum quia prius tractata est ab Aristotele, tum quod cognitio nostra incipit a sensu per illam; et quaestione sequenti scrutabimur viam, quae est per causam. Et quoniam *tempus* (ut lib. 4. dicebamus) est mensura motus, illud est, *quod nobis eius velocitatem ostendit.*[65]

Esta es una fundamentación que merece ser confrontada con aquella que encontramos en las *Abbreviationes* de Marsilio y en las *Questiones secundum nominalium viam.* Soto subraya la conexión con la metodología expresada por Aristóteles en *Física* I, 1 y en los *Analíticos Posteriores.* Como otros antes, hace corresponder el estudio *quo ad effectus* con la *scientia quia* y el *quo ad causas* con la *scientia propter quid.* A pesar de que este último represente la ciencia en sentido estricto, debe comenzarse por aquél. Ahora bien, no se comienza por la *scientia quia* porque el espacio sea “quasi effectus” (Johannes Marcilius de Inghen), sino porque *el tiempo es lo que nos muestra la velocidad del movimiento.* De aquí no se sigue necesariamente que la velocidad en la caída de los cuerpos aumente con respecto al tiempo.[66] Sin embargo, tal perspectiva y otros aspectos de la filosofía natural de Soto que nos vemos obligados a descuidar ahora, sí pueden haber provocado un cambio significativo para que la aplicación del teorema de la velocidad media –en el cual esa proporcionalidad ya existía– fuera posible.[67]

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[65] Ibid., 337F-338A (énfasis mío).

[66] Es más, Soto sigue afirmando igual que sus antecesores que la velocidad del movimiento local se mide por el espacio recorrido: “velocitas motus ab effectu (ut questione sequenti disputabitur) attenditur penes longitudinem spatii” (*questiones*, 325B-C).

[67] Este cambio de perspectiva remite a la discusión del concepto de tiempo en el libro IV, q. 4: utrum diffinitio temporis recte fuerit a Philosopho constituta (ibid., 246D-259D). Soto destaca la regularidad del movimiento del primer cielo (“regularissimus” y “simplicissimus”) y el hecho de que “ille est motus notissimus per motum solis, qui movetur quotidie motu primi mobilis, et ideo sol est signum temporis” (252E-F). Antes de exponer las opiniones de los “nominales” (Ockham y Gregorio da Rímini) y los “reales” (Paulus Venetus, Tomás de Aquino y Capreolus), Soto aclara que “inter omnes tamen primum omnium hoc convenit, quod tempus sit mensura certissima durationis, motuumque atque operationum corporalium rerum” (247E). W. A. Wallace recoge varios trabajos conectados con la aplicación del teorema de la velocidad media y el trasfondo filosófico relativo

VI

Este trabajo se ha ocupado de la distinción *quoad causas – quoad effectus* desde Bradwardine hasta Domingo de Soto. A lo largo de él han sido estudiados textos seleccionados de varios autores que llevan a cabo esa distinción. Con excepción quizá de Jacques Almain y Antonio Coronel, se trata siempre de autores suficientemente conocidos, de los cuales he intentado siempre ofrecer no sólo el texto original sino también la bibliografía correspondiente a cada uno. Hasta donde yo sé, se ha aceptado sin excepción la interpretación de la distinción escolástica *quoad causas – quoad effectus* como dinámica y cinemática; una interpretación que puede ser de gran utilidad didáctica para la organización del material correspondiente a una historia de la mecánica medieval, pero que, en realidad, es ella misma completamente anacrónica y falsa:

1) En primer lugar argumento a la inversa: si ambas son equivalentes, entonces la moderna distinción entre dinámica y cinemática se podría expresar mediante la distinción *quoad causas – quoad effectus*. Ahora bien, pensemos por un momento en un manual contemporáneo de "Introducción a la Física", el cual incluye la distinción entre dinámica y cinemática en términos aparentemente similares a la distinción escolástica –y que, por tanto, se podrían de nuevo proyectar en una reconstrucción de la mecánica medieval. Él establecería que en la cinemática llevamos a cabo una descripción matemática del movimiento en términos de espacio y tiempo; ¿dónde aparece y qué debería significar en la mecánica moderna que el espacio recorrido es un "efecto"? y, ¿por qué debería ser "mejor conocido para nosotros" o, en general, más cognoscible que los términos de la dinámica? No, ambas distinciones no son simétricas: la distinción escolástica contiene elementos que no son expresables con sentido en el "lenguaje moderno", y esos elementos se dejan comprender muy bien en el marco

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al problema del movimiento en su *Prelude to Galileo. Essays on Medieval and Sixteenth-Century Sources of Galileo's Thought*, Dordrecht/Boston/London 1981. Conviene destacar que Soto no sólo fue publicado y en general conocido en Italia, sino además copiado. El autor de las *Annotationes* en la edición de Wadding antes mecionada (cfr. n. 45) que contiene una *expositio* anónima además de las quaestiones de "Joannes-Marcilius" (bajo el nombre de Duns Scotus), *Franciscus Pitigianus Arretinus* (contemporáneo de Galileo), copia literalmente de Soto gran parte de la cuestión correspondiente incluyendo el pasaje en el que se ejemplifica un movimiento *uniformiter difformis* por medio de la caída de un grave (cfr. Di Liscia [cit. n. 33]).

de la tradición aristotélica, en cuyo desarrollo y en cuya conexión con tradiciones subordinadas, su concepción del método parece jugar un papel central.[68]

2) Hasta qué punto el empleo de categorías esencialmente metodológicas como *scientia a priori, demonstratio propter quid, scientia a posteriori, demonstratio quia*, han jugado un rol tan destacado en el estudio de la velocidad como –según p.e. Randall ha sostenido– en otros ámbitos de la filosofía natural es difícil decirlo. Un buena parte de esta historia comienza con el comentario de Grosseteste a los *Analíticos Posteriores*, en el cual está claramente expuesta la posibilidad de un doble tratamiento, *quia* y *propter quid*, incluso en la misma ciencia, para un mismo objeto.[69] Teóricos del llamado *regressus demonstrativus*, algunos de los cuales se superponen con los autores aquí estudiados, pretenden lograr esas conexión sin caer en circularidad. Por el contrario, en el análisis de la velocidad según las categorías metodológicas aristotélicas parece reinar una tajante separación y falta de comunicación entre ambas direcciones de estudio.[70] Cuando, Paulus Venetus por ejemplo, se expresa sobre la demostración *quia* como un proceso que va del efecto a la causa, se propone cuanto menos identificar la causa –o algún tipo de causa– que correspondería a un determinado fenómeno, luego de lo cuál seguiría un proceso inverso llamado *propter quid* y, bajo ciertas condiciones, un

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[68] El otro problema es de dónde viene en realidad la concepción de la cinemática como una rama de la mecánica. Nada hace pensar que ella, como sorprendentemente afirma J. Weisheipl, a quien tenemos tanto que agradecerle en este campo, pueda provenir del análisis escolástico *quoad effectus*: "The second consideration [velocity considered in respect of its effect] has to do with what Gaetano called the *a posteriori* condition of speeds effected, regardless of direction. This consideration of motion [*quoad effectum*] later came to be called 'kinematics'," (J. Weisheipl, "The Interpretation of Aristotle's Physics and the Science of Motion," en: Kretzmann/Kenny/Pinborg (eds.) (cit. n. 18), 521-36, aquí 534). El tema tiene que ser todavía investigado y la investigación debe incluir primero el término "phoronomia" (Cfr. J. S. Traugott Gehler, *Physikalisches Wörterbuch*, Bd. 7, Leipzig 1833, 472: bajo una acepción, "Phoronomie bezeichnet die Bewegung an sich ohne Rücksicht auf die bewengenden Kräfte").

[69] R. Grosseteste, *Comm. in Posteriorum* (cit. n. 7), I, 12, 189-90.

[70] De interés directo en relación a este artículo, pues incorpora el estudio de los calculadores desde el siglo XIV al XVI, es Wallace (cit. n. 7).

regresus demonstrativus.[71] Cuando, en cambio, los autores aquí mencionados (entre ellos el mismo Paulus Venetus) estudian la velocidad *quo ad effectus*, o construyen lo que ellos mismos llaman una ciencia *a posteriori* siguiendo el procedimiento *quia*, significa simplemente que no se trata en absoluto de causas. De hecho, el empleo de las categorías metodológicas parece no ir más allá de esta primera identificación entre "espacio recorrido" y "efecto", fuera de la cual el método no aporta nada nuevo: los enunciados científicos no son alterados, aceptados o rechazados a causa de presupuestos metodológicos.

3) La aplicación de la analogía con la dinámica y cinemática moderna uniformiza el pasado y bloquea nuestra comprensión del modo en el cuál esta tradición de ideas se desarrolla. La interpretación de *notiora nobis* como *effectus* posibilitó la comprensión del espacio recorrido como primer momento del análisis de la velocidad a partir de "lo más conocido para nosotros". Esta conexión entre efecto y espacio dió lugar a un diálogo intenso entre los tratados altamente desarrollados en la aplicación de las matemáticas al movimiento provenientes de la tradición mertonense y la más amplia estructura conceptual de la física aristotélica. Unificando dos aspectos que en el texto de la *Física* estaban separados –a los que he llamado "cuantitativo" y "metodológico"– se incorporó en el estudio de la velocidad una separación entre el análisis según los factores causales (fuerzas y resistencias) y el análisis según los efectos (espacio recorrido en un lapso de tiempo), que antes estaban unidos.

4) Los textos citados nos muestran no sólo el *factum* de que resultados mertonenses (como análogamente también en los campos de *maxima et minima* o *incipit et desinit*) son incluídos en el tratamiento de la filosofía natural, sino de qué modo ello ocurre: al menos en este punto parece claro que la tradición aristotélica se apropia de los resultados mertonenses *a través del método.* La aquí llamada "tradición de los calculadores" resulta de esa interacción.

5) Es cierto que la composición y adiestramiento "*in solvenda sophismata*" tiene que haber jugado un papel no desdeñable en el

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[71] Ver el texto citado por Wallace (cit. n. 7), 123-4. Mi afirmación, sin embargo, alcanza a los demás autores que comprendieron la *scientia quia* o *a priori* como un "proceso" del efecto a la causa, de lo cual Paulus Venetus sería aquí tan sólo un ejemplo aislado.

origen y desarrollo de la tradición de los calculadores –sobre todo de su contorno logicista–,[72] pero mucho más decisiva es, a mi juicio, la inclusión en los comentarios a la *Física*, por una razón: el juego lógico se convierte en ciencia. Ciertamente no en ciencia moderna sino en ciencia aristotélica.

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[72] Sobre el rol de la enseñanza de "*sophismata*" en el surgimiento y desarrollo de la tradición de los calculadores *cfr.* E. D. Sylla (cit. n 18) y también su "The Fate of the Oxford Calculatory Tradition," en: C. Wenin (ed.) *L'homme et son univers au moyen âge. Actes du Septième Congrès International de Philosophie Médiévale (30 Août - 4 Septembre 1982)*, Louvain-La-Neuve 1986, 692-8.

ALONSO DE LA VERACRUZ AS AN ARISTOTELIAN NATURAL PHILOSOPHER

Sarai Castro

At the beginning of the second half of the sixteenth century, Alonso de la Veracruz wrote a *Physica speculatio* as part of an arts course which he was devising for the Augustinian houses of study in Michoacán, in the New World. The course itself corresponded to the three-year arts programme commonly taught at Catholic European universities. At the University of Paris, for example, the first year was devoted to the *Summulae* of Peter of Spain, and dealt also with such subjects as exponibles, consequences and insolubles; the second year was spent reading Porphyry and Aristotle; and the third was devoted to Aristotelian physics, metaphysics and ethics.[1] At Alcalá the students followed a similar programme: in the first year they read the *Summulae*; in the second they covered Aristotle's *Categoria*, together with Porphyry's *Isagogus*, *De interpretatione*, the *Analytica posteriora*, the *Topica* and the *Sophistici elenchi*; and in the third year they studied Aristotelian natural philosophy and metaphysics, that is, the *Physica*, *De caelo*, *De generatione et corruptione*, the *Parva naturalis* and the *Metaphysica*.[2]

The content of the books prepared by Veracruz was determined by the requirements of the arts course. For logic he published the *Recognitio summularum* (Mexico City, 1554) and the *Dialectica resolutio cum textu Aristotelis* (Mexico City, 1557). The *Recognitio summularum* presented the fundamentals of logic according to the *Summulae* of Peter of Spain, including treatises on terms, exponibles, the syllogism, dialectical topics and fallacies. The *Dialectica resolutio*, which covered dialectics proper, was divided into three parts: the *Isagogus* of Porphyry was followed by Aristotle's *Categoria* and his *Analytica posteriora.* The *Physica speculatio* covered material taken from Aristotelian works on natural philosophy: the *Physica*, *De caelo*, *De generatione et corruptione*, the *Meteorologica* and *De anima*, including as an appendix the work of Campanus de Novara, the *Tractatus spherae.*

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[1] R. G. Villoslada, *La universidad de Paris durante los estudios de Francisco de Vitoria, O. P. 1507-1522*, Rome 1983, 42-3.

[2] J. Urriza, *La facultad de artes de la universidad de Alcalá de Henares* Madrid 1941-42, 116-7.

In his works, Veracruz states that his purpose was to make the study of philosophy accessible to his students. It was for this reason, for instance, that he vowed in the *Recognitio summularum* to get rid of the unnecessary aspects of logic, keeping only what was useful. He proposed to omit many features of the subjects which nominalist dialecticians, such as Naveros, Esbarroya and the Coronel brothers, had included in their writings, since it was his intention to eliminate superfluous sophisms, just as Jacques Lefevre d'Etaples, Ioannes Caesarius and Frans Titelmans had done (fols. 23v-24r). Similarly, in the prologue to his *Physica speculatio*, Veracruz announced that he would avoid useless discussions which had nothing to do with philosophy (1[3]).

Under the influence of Renaissance critics of medieval methods of teaching logic, new currents of thought were gaining favour in Europe in the middle of the sixteenth century. One of Veracruz' aims was to introduce these into the philosophy which was to be taught in the New World. In the *Recognitio summularum* he praised and used the work of Rudolph Agricola, whom he considered to be a second Aristotle. Veracruz combined Agricola's views with Aristotelian logic, producing a curious syncretism which also relied heavily on Titelmans and Caesarius. The latter was, however, dropped in later editions, probably because he was suspected of Lutheranism.[4] In the same way, Veracruz took into account in his *Dialectica resolutio* the new interest in Aristotelian logic based upon the *Analytica priora* and *posteriora.* Thus he placed strong emphasis on the role of logic in elaborating the structure of demonstration in the natural sciences and its use as an instrument of scientific knowledge, while also maintained elements of medieval scholastic logic.

In the *Physica speculatio* Veracruz showed the influence of his teacher, Domingo de Soto, particularly in his handling of the disputes between the realists and the nominalists of his day. Veracruz summarised practically everything that is to be found in de Soto's works, and, like him, attempted to bridge the gap between the two schools,[5] although Veracruz also criticised the nominalists for wasting so much time and energy in fruitless efforts. For himself, Veracruz generally followed Thomas Aquinas and Giles of Rome, a realist in his teaching. For instance, in the *Physica speculatio*, book 1, *speculatio* 2 he enquired whether the changeable body (*corpus mobile*) was the subject of natural science (4-6). In response he pointed out that some authors held that the subject of natural science was the natural body itself (*corpus naturale*), others that it was the finite substance (*substantia finita*), and still others that it was the changeable being (*ens mobile*) (4). Veracruz followed those who believed the subject of natural science to be the changeable being, also the position of Thomas. He did, however, also acknowledge the opinion of Giles of Rome, who proposed that the subject was the changeable body, while, as Veracruz pointed out, considering the opinion that the subject was the changeable being also to be credible. The remainder of this *speculatio* explained Thomas' arguments and countered possible objections (5-6).

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[3] Figures in brackets refer to page numbers of Veracruz' *Physica speculatio.*

[4] V. Muñoz Delgado, *Lógica Hispano-Portuguesa hasta 1600*, Salamanca 1970, 86.

In the same first book of the *Physica speculatio*, at *speculatio* 5, Veracruz addressed the subject of the demonstrative *regressus*, although he did not use this term.[6] Veracruz enquired "whether in this [physical] science one should begin from the knowledge of principles and proceed from the more universal to the less universal" (12-13). He acknowledged the opinions of Avicenna, Averroes, Thomas Aquinas, Giles of Rome and Paul of Venice. In the formulation of his own opinion, Veracruz made the distinction between intellective and sensitive knowledge. Thus, he stated as his first conclusion that "speaking of intellective knowledge, the mode of proceeding is from the more universal to the less universal" (14), arguing that this is the order followed by the intellect. That is to say, for instance in the case of the knowledge of man, that the intellect judges first that it is a being, second that it is alive, and third that it is a man (14). The *progressus* in us is, then, from the imperfect and confused to the distinct and perfect (14). Because of this, Veracruz added as his second conclusion, "this *progressus* is according to nature not only when our knowledge is confused but even when it is distinct" (15). However, in a comparison between sensitive knowledge and intellective knowledge, Veracruz states in his third conclusion, "since sensitive knowledge precedes intellectual knowledge, the *progressus* will be from singulars to universals and thus from what is better known to us to what is better known to nature" (15).

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[5] W. A. Wallace, *Prelude to Galileo*, Dordrecht/Boston 1981, 85-6.

[6] This passage is extremely relevant to the discussion here and elsewhere in this volume, and I am indebted to Professor W. A. Wallace for drawing it to my attention.

Veracruz added two conclusions to explain the difference in approach of the *regressus* in demonstration to what he had already described. As his fourth conclusion he said that "just as before the knowledge of principles the *processus* is from singulars to universals—proof by induction—so when these same [principles] are known, the *progressus* is from universals to the particulars of reason" (15). Applying these ideas to the problem of demonstration in the sciences, Veracruz proposed as his fifth conclusion that "while in demonstration *quia* the *progressus* is from what is better known to us to what is less known to us, in demonstration *propter quid*—which is *potissima*—the procedure is certainly [to move] from what is less known to us and better known in nature to what is less known in nature and better known to us" (15).[7]

In the *Physica speculatio* Veracruz demonstrated his interest in introducing new ideas and a contemporary approach to the study of natural philosophy. He displayed some familiarity with the writings of Renaissance scholars such as Pico della Mirandola, whom he described as *vir acutissimus et doctissimus philosophus* (223, 249). Yet perhaps the most interesting aspect of his work is the manner in which he illustrated his material and the way in which he collected his information. He described his physical surroundings in America with great enthusiasm. He also included reports about new discoveries which seem to have been sent to him at his own request by other Europeans travelling elsewhere. Thus he recorded the sighting of a comet in New Spain at the beginning of March 1556 (244). In addition, using knowledge of physical phenomena of the New World acquired through his own observations, he described the location of Mexico City and the climate of the region, noting that it rained so much during the autumn that in 1555 Mexico City was flooded (104, 106, 240). As well, Veracruz supplemented his own descriptions of the New World with reports about the Far East received from Fray Martin de Rada and Fray Agustin de Urdaneta.[8] But Veracruz was not content with repeating what previous writers had said. He used his data to refute some of the misconceptions found in the works of writers such as Luis Coronel, who maintained, for example, that the torrid zone was uninhabitable. Veracruz pointed out that New Spain was located in the torrid zone and that many people lived there nonetheless (232).

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[7] This is the teaching of the Jesuits which was sustained by Galileo, as argued by Wallace elsewhere in this volume.

Veracruz' *Physica speculatio* and his other works represent his efforts to help his students to become acquainted with the rudiments of logic and philosophy, which would then equip them to pursue higher studies. He himself declared that his main purpose was to eliminate the most tedious and confusing parts of these subjects rather than to present anything new. He repeatedly stated that his purpose was to alleviate his young students' difficulties in learning.

The approach that Veracruz took to his material is evidence of his intention. Rather than commenting on the Aristotelian texts line by line, he took the main ideas and explained them using the scholastic method of question and answer. First, he stated the *speculatio*; next he presented the contrary position and the arguments in its favour; finally he declared his own opinion in the form of conclusions supported by other commentators and usually by Aristotle himself. For instance, in his exposition of the first book of Aristotle's *De anima*, Veracruz went straight to the point, asking whether the study of the soul belonged to physics or to metaphysics (*speculatio* 1, 271-273). Having answered that it belonged to physics, he went on to discuss the definition of the soul (*speculatio* 2, 273-275) and the classification of the soul into three types (vegetative, sensitive, and rational), together with its five powers (vegetative, sensitive, appetitive, motor and intellective) (*speculatio* 3, 278-280). Finally he asked the question of whether the knowledge of the accidents can lead to the knowledge of the substance, answering that common accidents gave only a confused knowledge of the substance, while the proper accidents gave a distinct knowledge of the substance (*speculatio* 5, 281-283).

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[8] MS Paris, Bibliothéque Nationale, fonds espagnols, 325, contains several documents which seem to have belonged to Veracruz. Some are in his own hand and most have been annotated by him [see Alfred Morel Fatio, *Catalogue des Manuscrits espagnols portugais de la Bibliothéque Nationale*, Paris 1892, 162-5]. Among the papers are the *Relaciones* sent be Urdanata to the Spanish King and letters from Rada to Veracruz describing his trips to the Philippines and China (fols. 3r-11r).

In this way Veracruz sought to produce an appropriate teaching programme for his young students by combining scholastic methods with new empirical evidence and taking account of the contemporary discussions of method and dialectics in Catholic Europe.

KEEPING ORDER IN THE SCHOOL OF PADUA: JACOPO ZABARELLA AND FRANCESCO PICCOLOMINI ON THE OFFICES OF PHILOSOPHY*

Nicholas Jardine

I

Recent studies of sixteenth-century Paduan logicians and natural philosophers have for the most part focused on just two out of the vast range of topics on which they pronounced and disputed: the nature of demonstrative method in the sciences; and the nature and faculties of the human soul. These are evidently exciting topics—Paduan views on demonstrative method being, so we have been told since Ernst Cassirer, somehow implicated in the formation of the new Galilean science,[1] and Paduan views on the soul, so it has been suggested at least since Pierre Bayle, having a place in the annals of free thought in the face of religious superstition.[2] I shall here explore a topic that has no such glamorous

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[*] I am grateful to other participants in the Seminar on Method in Sixteenth-Century Aristotle Commentaries held at the Herzog August Bibliothek, Wolfenbüttel in September 1992 for much advice and constructive criticism: Heikki Mikkeli, in particular, contributed indispensable guidance both through his book on Zabarella (see note 11, below), which I first saw at the Seminar, and through his helpful and generous comments on a draft of this paper. Sachiko Kusukawa reminded me of the importance of God; and Marina Frasca-Spada helped me to improve the *ordo* of my writing. I am substantially indebted also to Andrew Cunningham, whose work on Fabricius (see note 71, below) provided a model for my own attempts to understand what the Paduan natural philosophers were up to. Fig. 1 is from L. Rossetti, *The University of Padua: An Outline of its History*, Trieste ^{2}1983, 35, photo by Giorgio Ddeganello, by kind permission of Edizioni LINT. Figs. 2, 3 and 4 are reproduced by kind permission of the Syndics of Cambridge University Library.

[1] E. Cassirer, *Das Erkenntnisproblem in der Philosophie und Wissenschaft der neueren Zeit*, Berlin 1906, ^{2}1911, vol. 1, 136-44.

[2] P. Bayle, *Dictionnaire historique et critique*, Rotterdam, 1695-7, vol. 1, entry under "Cremonin (César)," and vol. 2, entry under "Pomponace (Pierre)."

historiographical pedigree, *ordo doctrinae*, the order in which disciplines and parts of disciplines are to be addressed in teaching. In particular, I shall be concerned to show how in their controversy on this issue two leading Paduan professors of natural philosophy, Jacopo Zabarella and Francesco Piccolomini, revealed their very different perceptions of academic and civil order and defended their very different views of the philosopher's place in that order.

II

To set the stage I shall detail the main points of the inaugural lecture delivered in 1585 by Zabarella on his promotion from the first extraordinary to the second ordinary chair in natural philosophy at the University of Padua.[3]

Zabarella opens his lecture by saying that he will leave aside the conventional encomium of philosophy and talk instead of the *ratio philosophandi*. In particular, he will consider "first what *ratio* of philosophising Aristotle used, then what we must do in order to be said to philosophise on Aristotle in a correct and Aristotelian manner."[4] We have, Zabarella declares, no innate principles of knowledge—all proceed ultimately either from divine "infusion" or from the senses.[5] In the latter domain, that proper to natural philosophy, Aristotle is pre-eminent by virtue both of the firmness and solidity of his dogmas and of the excellence of the "method and mode of teaching" through which he handed on his philosophy.[6]

Zabarella then spells out his aims:

> I indeed think that the right and perfect exposition of the books of Aristotle is established in three ways, having observed which one may be said to philosophise best in the school of Aristotle. One is that we should reveal the arts by which the works of Aristotle were written and the fabric and artful structure of each book; another is that we should weigh up and expound Aristotle's words most diligently; the last is that the sense of what has been set out by him so briefly and obscurely as to excite great dissensions and

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[3] "Una 'oratio' programmatica di G. Zabarella," ed. M. Dal Pra, in: *Rivista critica di storia della filosofia* 21 (1966), 286-90.

[4] Ibid., 286-7.

[5] Ibid., 287.

[6] Ibid., 287-8.

> disputations of the interpreters, should be rendered so clear and open that, if possible, all doubt may be removed.[7]

The key to the first of these tasks, revelation of the "fabric and artful structure" of Aristotle's writings, is the cultivation of logic. (Zabarella here refers to his own earlier logical works.) The key to the second task, assessment and exposition of Aristotle's words, is minute attention to the Greek text, the mistranslation of which has produced endless sterile disputations amongst the Latin commentators.[8] The key to the third task, that of interpretation of obscure passages, is the imitation of Aristotle. Such imitation does not consist in the following of Aristotle's opinions, but in the emulation of Aristotle's artfulness in philosophising whereby: "things are dealt with first that appear to be necessary or useful for the knowledge of others, and every single thing is expounded and demonstrated from proper principles as derived from the very nature of the thing."[9]

Zabarella concludes by urging the "noble youths" to diligence in reading and attending his lectures, and by promising to do all he can to help them in their study of Aristotle.[10]

In the *Opera logica*, to which he refers in this lecture, Zabarella had treated logic not as a science but as the source of *methodus*, instruments which possess *vis notificandae*, a power of making things known to us in the various disciplines.[11] *Methodus* he had divided into *methodus sensu strictu* and *ordo. Methodus sensu strictu* covers all procedures by which we advance from what is known to knowledge of what is unknown. It is through *methodus* that we learn.[12] *Ordo*, by contrast, is concerned with the teaching of what is known. Zabarella defines it as follows: "*Ordo doctrinae* is an instrumental *habitus* through which we are prepared so to dispose the parts of each discipline that that discipline may be taught as well and easily as possible."[13]

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[7] Ibid., 289.

[8] Ibid., 289-90.

[9] Ibid., 290.

[10] Ibid., 290.

[11] *Opera logica*, Venice, 1578; *In II Aristotelis Posteriores analyticos commentarii*, Venice, 1582. I have used the Hildesheim, 1966, reprint of the Cologne, 1597, edition in which the two works were published together with Zabarella's *De doctrinae ordine apologia*, first published Venice, 1584.
On Zabarella's logic see W. F. Edwards, "The Logic of Jacopo Zabarella (1533-1589)," Ph.D. Thesis, Columbia University 1960; W. Risse, "Zabarellas Methodenlehre," in: *Aristotelismo veneto e scienza moderna*, ed. L. Olivieri, Padua 1988, 155-72; W. Schmidt-Biggemann, *Topica Universalis. Eine Modellgeschichte humanistischer und barocker Wissenschaft*, Hamburg, 1983, 67-81; H. Mikkeli, *An Aristotelian Response to Renaissance Humanism: Jacopo Zabarella on the Nature of the Arts and Sciences*, Helsinki 1992, ch. 3.

It is to *ordo* that Zabarella refers again and again in his lecture. It is for his *ordo* that he praises Aristotle at the outset; it is understanding of the *ordo* of Aristotle's writings that he presents as the primary goal of Aristotelian philosophising; and it is, so he claims, through emulation of Aristotle's *ordo* that all obscurities in Aristotle can in principle be clarified.

Even a glance through Zabarella's works gives us good reasons to take at face value these declarations about *ordo* as the basis of all sound philosophising. For an extraordinarily large proportion of his writings, both commentaries and treatises, is taken up with questions of *ordo*. Throughout we find disquisitions on the *ordo* of Aristotle's books, on the chapters of the books, and on the topics within each chapter, along with reconstructions of Aristotle's reasons for these orders and justifications of the reconstructions by appeal to Zabarella's own account of *ordo doctrinae*. In connection with *ordo* Zabarella becomes almost compulsively reflexive, constantly concerned with the order of his own exposition, constantly describing, justifying and recapitulating it. In connection with *ordo* Zabarella breaks his rule (announced in his inaugural lecture) of setting aside topics not treated by Aristotle: this is, as far as I know, the only issue on which Zabarella writes at length whilst acknowledging that Aristotle had failed adequately to address it.[14] In connection with *ordo* Zabarella makes one of his few explicit claims for the originality of his own views.[15] And, as we shall see, it was on the issue of *ordo* that he was involved in the only really bitter controversy of his career.

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[12] *Opera logica*, cols 223-6.

[13] Ibid., col. 154.

[14] Book IV, Ch. XXII of *De methodis* (*Opera logica*, cols 330-4) is concerned with the issue of Aristotle's failure to offer an explicit account of *ordo doctrinae*: in particular, Zabarella argues that while Aristotle distinguished *methodus* from *ordo* he offered no extended treatment of *ordo*, partly because his primary concern was not with teaching but with acquisition of *scientia* and partly because he took the types of *ordo* and their uses to be sufficiently obvious to be taught by example.

[15] *Opera logica*, col. 184: "Now we must endeavour to find out the true differences by which we may divide order into species; nor must we hesitate to set out our

A deep concern with *ordo doctrinae* is not, of course, peculiar to Zabarella. Classical commentators, out to build Aristotle's works into a curriculum, had shown much interest in the *ordo* of Aristotle's books and of the disciplines with which they deal; and this attention to issues of *ordo* remains central in Arabic and Latin commentary.[16] The standard forms of academic communication, *quaestio* and *disputatio*, depending as they did on memory of elaborate sequences of propositions, objections, counter-objections, resolutions, etc., dictated a constant awareness of literary *ordo*, especially when as at Padua reading from notes by lecturers was frowned on. Moreover, an increased concern with teaching procedures was a part of the legacy of humanism that had achieved Europe-wide currency by the time Zabarella wrote. It is, however, my firm impression that sixteenth-century Paduan natural philosophers were exceptional in the extent to which they addressed and disputed questions of *ordo*. Why were they thus obsessed?

Part of the answer is straightforward—and is, indeed, explicit in Zabarella's lecture. The Paduan philosophers were united in their effort to get behind the mass of the Arab and medieval Latin commentators' accretions and distortions in order to recover a purified Aristotle. One means to this end was, as Zabarella notes, to attend minutely to the Greek text: another was to reconstruct the *ordo* of Aristotle's writings, for thus, as Zabarella says, it is possible for the philosopher to uncover the mind of Aristotle in his works. This approach was not peculiar to the Aristotelians. Such Paduan Galenists as Niccolò Leoniceno and Giambattista da Monte, seeking to excavate a pure Galen from beneath the heap of commentary, had devoted the same kind of attention to the Greek text and its principles of *ordo*.[17] However, this can only be a partial explanation; for in Genua, Zabarella, Piccolomini and Cremonini, only a

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opinion in this matter even if it is new and, as it appears, known to none after Aristotle right up to the present time."

[16] On the imposition of order on Aristotle's works by the Greek commentators see R. Sorabji, "The ancient commentators on Aristotle," in: idem (ed.), *Aristotle Transformed*, London 1990, 1-30.

[17] O. Temkin, *Galenism*, Ithaca 1973, 125-7; W. F. Edwards, "Niccolò Leoniceno and the origins of humanist discussion of method," in: E. P. Mahoney (ed.), *Philosophy and Humanism: Renaissance Essays in Honor of Paul Oskar Kristeller*, Leiden 1976, 283-305; J. L. Bylebyl, "Medicine, philosophy and humanism in Renaissance Italy," in: J. W. Shirley and F. D. Hoeniger (eds.), *Science and the Arts in the Renaissance*, Washington 1985, 27-49.

part of the copious discussion of *ordo* is directly engaged in the interpretation of Aristotle's writings. The bulk of the discussion treats of the *ordo* of disciplines, their status, their dignity and their modes of mutual dependence; and the terms of reference here are far wider, the tenor of the writing far more heated, than was usual in the ritual disputations of the period on precedence in the arts and sciences.[18] What else may have been at stake for these Paduan philosophers?

III

The University of Padua was in this period the only university of the Veneto and the only one the Venetians were allowed to attend. The Republic of Venice, a hereditary oligarchy, was rigorously ordered in its estates and institutions. *Ordo* was a notion central to its self-image as the last bastion of republican liberty. Its panegyrists and historiographers tirelessly celebrated the well-ordered character of its government and institutions; and amongst the nobles the rising party of the *giovani* pursued reform in the name of restitution of its original, most perfect and well-tempered order, an order that they commonly identified with the "mixed constitution" of Aristotle's *Politics*.[19]

Following the reopening of the University of Padua after the war of the League of Cambrai in 1517, the Venetians re-established control over all aspects of its finance and administration, and after 1560 its appointments and curriculum as well.[20] However, though absolute, the senatorial government through three delegated *riformatori* was tolerant, the views of the student nations and the professoriate being consulted through a representative body and the traditional rights and privileges of the students and professors being respected. Although the Venetian authorities accepted the Tridentine decrees, in practice both University teachers and the lucrative foreign students enjoyed a measure of protection against inquisition and censure.[21] The University itself was governed by the strictest order, the professors being ranked according to the status of their disciplines in a way which determined their precedence in processions and at table, the sumptuousness of their costumes, and their publicly advertised salaries.

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[18] See E. Garin, *La disputa delle arti nel Quattrocento*, Florence 1947.

[19] These remarks are based on W. J. Bouwsma, *Venice and the Defence of Republican Liberty*, Berkeley, 1968, ch. 5: "Venice under the *giovani*."

[20] The following remarks are largely based on L. Rossetti, *The University of Padua: An Outline of its History*, tr. A. W. Maladorno Hargreaves, Trieste, 1983, and J. L. Bylebyl, "The School of Padua: humanistic medicine in the sixteenth century," in: C. Webster (ed.), *Health, Medicine and Mortality in the Sixteenth Century*, Cambridge 1978, 335-70.

The University was, in fact, not one but an alliance of two universities—the *universitas iuristarum*, catering for about two thirds of the students, and the *universitas artistarum*, in which the vast majority of those who matriculated did so in medicine and philosophy. A handful of the arts students graduated in theology (the theology university having long ago been incorporated into the arts university). Many youths of the Venetian nobility, however, did not pursue a degree, undertaking their studies privately in the houses of the arts professors.

As shown in the annual *rotuli* of the University (Fig. 1), the rigid ordination of disciplines and chairs—ranging from theology and metaphysics *in via Tomae* and *Scoti* at the top, through theoretical medicine and law, followed by philosophy, with *studia humanitatis*, surgery, and other practical disciplines bringing up the rear—had changed little over almost three centuries. But it was not entirely inflexible. For example, the teaching of anatomy achieved progressively higher status from the 1530s, culminating in an ordinance of 1584 assigning to Girolamo Fabricius an ordinary professorship in anatomy ranked above the chairs of natural philosophy, where previously anatomy had been associated with surgery and ranked well below natural philosophy. Just how sensitive were these issues of order is attested by Fabricius' outraged protests when his name was accidentally printed twice on the University

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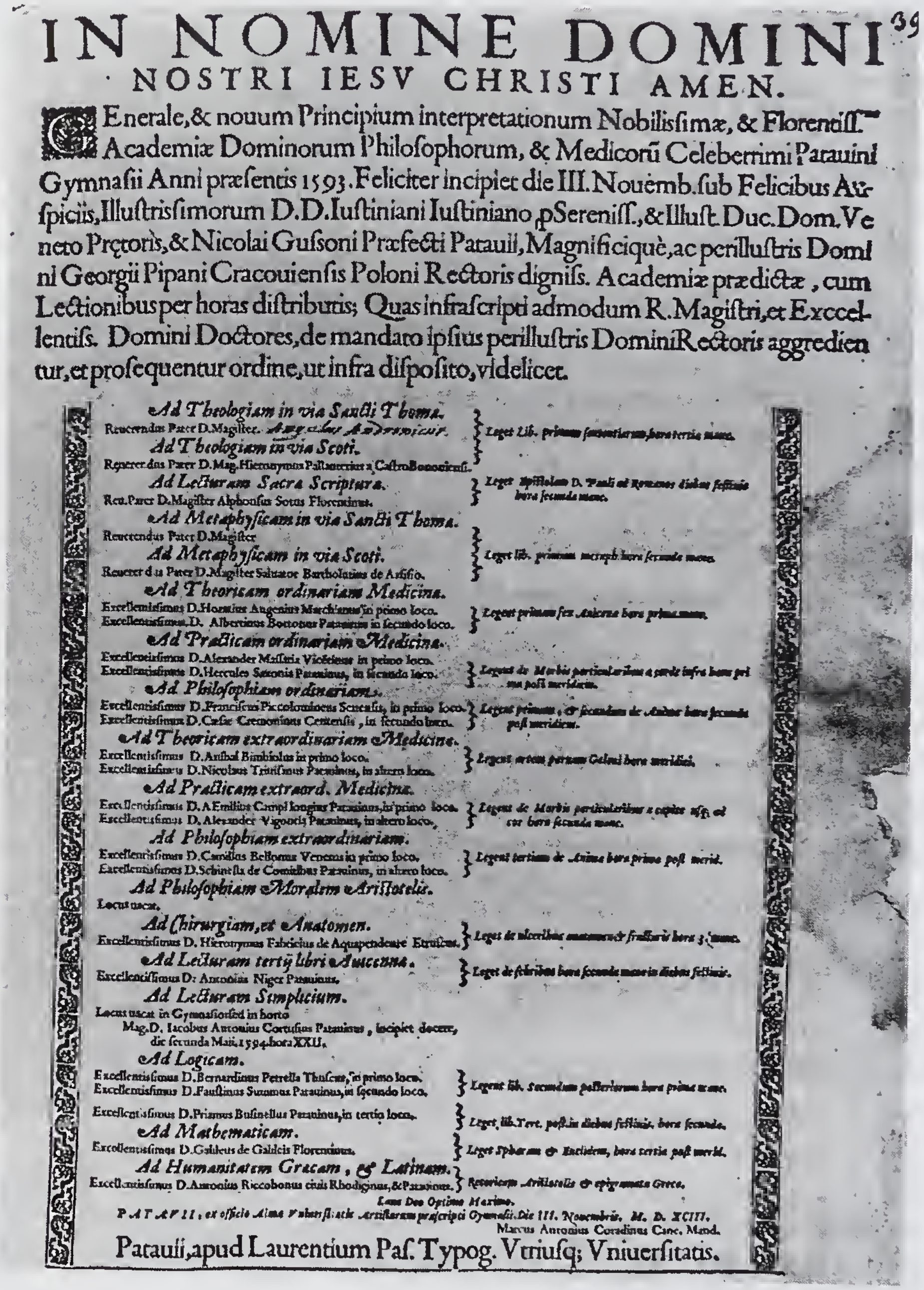
[21] O. Logan, *Culture and Society in Venice, 1470-1790*, London 1972, 88-9, argues that "it is advisable to speak of haphazardness of prosecution rather than of a consistent policy of toleration as such;" see also R. Palmer, "Physicians and the Inquisition in sixteenth-century Venice: the case of Girolamo Donzellini," in: O. P. Grell and A. Cunningham (eds.), *Medicine and Reformation*, Cambridge 1993, 118-33. For examples of protection of foreign students see G. Brugi, "Gli studenti tedeschi e la S. Inquisizione a Padova nella seconda metà del secolo XVI," in: *Atti del Reale Istituto Veneto di Scienze, Lettere ed Arti*, 8ª serie 5 (1894), 1015-33. On the crucial issue of censorship see P. F. Grendler, *Culture and Censorship in Late Renaissance Italy and France*, London 1981, ch. 9: "The Roman Inquisition and the Venetian Press, 1540-1605."

rotulus for 1597, once as Professor of Anatomy above the philosophers, once as Professor of Surgery below them.[22]



IN NOMINE DOMINI 39
NOSTRI IESV CHRISTI AMEN.

Generale, & nouum Principium interpretationum Nobiliſsimæ, & Florentiſſ. Academiæ Dominorum Philoſophorum, & Medicorū Celeberrimi Patauini Gymnaſii Anni præſentis 1593. Feliciter incipiet die III. Nouēmb. ſub Felicibus Auſpiciis, Illuſtriſsimorum D.D. Iuſtiniani Iuſtiniano ꝓSereniſſ., & Illuſt. Duc. Dom. Veneto Prętoris, & Nicolai Guſsoni Præfecti Patauii, Magnificiquè, ac perilluſtris Domini Georgii Pipani Cracouienſis Poloni Rectoris digniſs. Academiæ prædictæ, cum Lectionibus per horas diſtributis; Quas infraſcripti admodum R. Magiſtri, et Excellentiſs. Domini Doctores, de mandato ipſius perilluſtris Domini Rectoris aggredientur, et proſequentur ordine, ut infra diſpoſito, videlicet.

Ad Theologiam in via Sancti Thomæ.
Reuerendus Pater D. Magiſter. Angelus Andronicus.
Ad Theologiam in via Scoti.
Reuerendus Pater D. Mag. Hieronymus Pallantierius a Caſtro Bononienſi.
Leget Lib. primum ſententiarum, hora tertia mane.
Ad Lecturam Sacræ Scripturæ.
Reu. Pater D. Magiſter Alphonſus Sotus Florentinus.
Leget Epiſtolam D. Pauli ad Romanos diebus feſtiuis hora ſecunda mane.
Ad Metaphyſicam in via Sancti Thomæ.
Reuerendus Pater D. Magiſter
Ad Metaphyſicam in via Scoti.
Reuerendus Pater D. Magiſter Saluator Bartholutius de Aſiſio.
Leget lib. primum metaph. hora ſecunda mane.
Ad Theoricam ordinariam Medicinæ.
Excellentiſsimus D. Horatius Augenius Marchianus in primo loco.
Excellentiſsimus D. Albertinus Bottonus Patauinus in ſecundo loco.
Legent primam fen. Auicennæ hora prima mane.
Ad Practicam ordinariam Medicinæ.
Excellentiſsimus D. Alexander Maſſaria Vicētinus in primo loco.
Excellentiſsimus D. Hercules Saxonia Patauinus, in ſecundo loco.
Legent de Morbis particularibus a corde infra hora prima poſt meridiem.
Ad Philoſophiam ordinariam.
Excellentiſsimus D. Franciſcus Piccolomineus Senenſis, in primo loco.
Excellentiſsimus D. Cæſar Cremoninus Centenſis, in ſecundo loco.
Legent primum, & ſecundum de Anima hora ſecunda poſt meridiem.
Ad Theoricam extraordinariam Medicinæ.
Excellentiſsimus D. Anibal Bimbiolus in primo loco.
Excellentiſsimus D. Nicolaus Triuiſanus Patauinus, in altero loco.
Legent artem paruam Galeni hora meridiei.
Ad Practicam extraord. Medicinæ.
Excellentiſsimus D. Aemilius Campilongus Patauinus, in primo loco.
Excellentiſsimus D. Alexander Vigontia Patauinus, in altero loco.
Legent de Morbis particularibus a capite uſq. ad cor hora ſecunda mane.
Ad Philoſophiam extraordinariam.
Excellentiſsimus D. Camillus Bellonus Venetus in primo loco.
Excellentiſsimus D. Schinella de Comitibus Patauinus, in altero loco.
Legent tertium de Anima hora prima poſt merid.
Ad Philoſophiam Moralem Ariſtotelis.
Locus uacat.
Ad Chirurgiam, et Anatomen.
Excellentiſsimus D. Hieronymus Fabricius de Aquapendente Etruſcus.
Leget de ulceribus tumoribus & fracturis hora 3. mane.
Ad Lecturam tertij libri Auicennæ.
Excellentiſſimus D. Antonius Niger Patauinus.
Leget de febribus hora ſecunda mane in diebus feſtiuis.
Ad Lecturam Simplicium.
Locus uacat in Gymnaſio ſed in horto
Mag. D. Iacobus Antonius Cortuſius Patauinus, incipiet docere, die ſecunda Maii, 1594. hora XXII.
Ad Logicam.
Excellentiſsimus D. Bernardinus Petrella Thuſcus, in primo loco.
Excellentiſsimus D. Fauſtinus Summus Patauinus, in ſecundo loco.
Legent lib. ſecundum poſteriorum hora prima mane.
Excellentiſsimus D. Priamus Buſinellus Patauinus, in tertio loco.
Leget lib. Top. poſt. in diebus feſtiuis, hora ſecunda.
Ad Mathematicam.
Excellentiſsimus D. Galileus de Galileis Florentinus.
Leget Sphæram & Euclidem, hora tertia poſt merid.
Ad Humanitatem Græcam, & Latinam.
Excellentiſsimus D. Antonius Riccobonus ciuis Rhodiginus, & Patauinus.
Rhetoricam Ariſtotelis & epigrammata Græca.

Laus Deo Optimo Maximo.
PATAVII, ex officio Almæ Vniuerſitatis Artiſtarum præſcripti Gymnaſii. Die III. Nouembris, M. D. XCIII.
Marcus Antonius Coradinus Canc. Mand.
Patauii, apud Laurentium Paſ. Typog. Vtriuſq; Vniuerſitatis.

Figure 1

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[22] G. Favaro, "L'insegnamento anatomico di Girolamo Fabrici d'Acquapendente," in: *Monografie storiche sullo Studio di Padova*, Venice 1922, 107-35 (here 130). Before 1597 the *rotuli* that I have seen ignore the promotion of Fabricius' chair in anatomy.

Public disputations between professors, generally conducted with elaborate civility, were common at Padua throughout the period. The custom of lecturing *in concurrentia* on the same topics was conducive to disputation. And the professors were actively encouraged by their patrician Venetian patrons and former students to prove their mettle through eloquent and learned controversy both in the university context and in the more informal setting of the *Accademia degli Infiammati*.[23] Zabarella had himself conducted such urbane disputes.[24] His clash with Piccolomini, however, was by no means of this civilised and ritualised sort. Here, as we shall see, each party charged the other with violation of the rules of honourable disputation; and the dispute concluded with a flagrant breach of etiquette, an abusive attack by Piccolomini on the recently deceased Zabarella.

IV

In his chronicle of the University of Padua published in 1757 Jacopo Facciolati, official historiographer of the University, records and contrasts two events for 1584, the year before Zabarella's inaugural lecture on the *ratio philosophandi*. One is the flourishing of medical studies as attested by the establishment of the first public indoor anatomy theatre. The other he treats with enlightened contempt:

> A very small matter grew into a great battle between the chief professors of the arts, Jacopo Zabarella and Francesco Piccolomini, who fought bitterly both

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[23] Encouragement and sponsorship of Paduan disputations by patrician Venetian patrons deserves much further investigation. Valuable leads are to be found in M. Biagioli's marvellous *Galileo, Courtier: The Practice of Science in the Culture of Absolutism*, Chicago, 1993. Biagioli shows how in the mathematical and philosophical tournaments of absolutist Florence and Rome princely patrons and their champions engaged in elaborate "courtship", the champions seeking commitment from patrons reluctant to have their honour exposed too openly in dispute. My preliminary work suggests that in Republican Venice patrons—often patrician former students—were less reticent: they allowed open appeals to their authority in dedicatory letters and prefaces to contentious works; and on occasion such works were published under their names.

[24] For example Zabarella and Bernardino Petrella, who had earlier lectured *in concurrentia* on logic, conducted through publication under the names of patrician students a lengthy and elaborately civil controversy on the species of demonstration: see P. Ragnisco, "Una polemica di logica nell'Università di Padova nelle scuole di B. Petrella e di G. Zabarella," in: *Atti del Reale Istituto Veneto di Scienze, Lettere ed Arti*, 6ª serie 4 (1885-6), 463-502; C. H. Lohr, *Latin Aristotle Commentaries. II, Renaissance Authors*, Florence 1988, 325-6.

> verbally and in writing over whether the way and basis of doctrine proceeds more correctly from things known to nature herself than from the things that are known to us. Whence it is evident what sort of mode of philosophising occupied the schools in those days.[25]

Facciolati's reference here is to the publication of Zabarella's *De doctrinae ordine apologia*, a heated defence of his position against Piccolomini's attack. As we explore the background to this, we shall find that the events contrasted by Facciolati are intimately linked.

In 1578 Zabarella had published his *Opera logica*, nine substantial treatises on debatable Aristotelian logical questions. The first two books of his treatise *De methodis* are devoted to *ordo doctrinae.* One of his central claims is that it is our distinct cognition rather than the nature of things that provides the *ratio* of ordering, the proper *ordo* being always that which is needed to convey distinct cognition to the student.[26] Another is that there are only two species of *ordo* (not, as the Galenists claim, three or four):

> one is the compositive, which, starting out from first principles, proceeds to posterior principles and to those things which depend on principles, and from simple things to composite ones, so that perfect cognition of things may be handed on; the other is the resolutive, which, when a final end to be achieved or brought about by us has been posited, proceeds to the seeking out of the first principles through which we may afterwards produce and establish that end.[27]

The compositive order is, Zabarella goes on to argue, peculiar to the contemplative sciences, the resolutive to the practical arts.[28]

In 1583 Francesco Piccolomini strongly attacked Zabarella's claims concerning *ordo.* His *Universa philosophia de moribus* was dedicated to the Venetian Senate, especially to the "gymnasiarchs", that is, the *riformatori* who governed the University. It is a massive treatise on ethics, presented as a course of education and edification for young noblemen destined for high office.[29] It is ordered in ten steps, of which the first six—dealing, respectively, with perturbations of the soul, principles of virtue, prudential virtues, virtues of manners, virtues of reason, and heroic virtues—correspond to the successive stages in an ideal life of service to the Venetian state, proceeding from the distractions of sportive youth to the heroic acts of the highest magistrate. The final four stages—dealing, respectively, with public amity, nature and fortune, the purpose of virtue, and the highest good—correspond to the reign of justice under the wise government of the "perennial, almost divine" Venetian senate.

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[25] *Fasti Gymnasii Patavini*, Padua 1757, 220.

[26] *Opera logica*, col. 180.

[27] Ibid., cols 180-1.

[28] Ibid., cols 181-93.

[29] Venice 1583. I have worked with the Frankfurt, 1627, edition. On Piccolomini's ethics see A. E. Baldini, "La politica etica di Francesco Piccolomini," in: *Il pensiero politico. Rivista di storia delle idee politiche e sociali*, 12 (1980), 161-85; A. Poppi, "Il problema della filosofia morale nella scuola padovana del Rinascimento: Platonismo e Aristotelismo nella definizione del metodo

A central, perhaps the central, topic of Piccolomini's work is the "divine constitution of *ordo*", a constitution that is succinctly sketched in the epitome of his teachings found in the work of his student Tommaso Contarini:

> Four principal grades of order are taken into consideration: for order is in God through the mode of cause; it is in the intelligences and in their virtue in the heaven through form; it is in the mortal world through participation; in those things that are rightly done by man through imitation, for art imitates nature. Order in God is providence, in the heaven fate, in the mortal sphere nature, in cities it is law and justice, in the body it is health, in the soul virtue, in artful works it is their proper plan, and in sciences and disciplines it is the correct imitation of nature.[30]

In the opening chapters of the *Universa philosophia* Piccolomini attacks Zabarella personally, though not by name. He charges him with "calumny" against those who disagree with him on the topic of *ordo*;[31] and he also implies that Zabarella has been dishonourable in claiming originality for his view that there are only two orders of doctrine, when he knew very well that this view had been publicly promoted by Piccolomini, as is evident from the works of his noble students, notably Tommaso Contarini.[32] Piccolomini goes on to contest Zabarella's views,

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dell'etica," in: *Platon et Aristote à la Renaissance*, XVI^{e} Colloque international de Tours, Paris 1976, 105-46.

[30] *Librorum de humana tranquillitate aeneas una*, Venice, 1572, f. 16r-v.

[31] *Universa philosophia*, 52.

[32] Tommaso Contarini (as note 30), f. 15r-16v. Contarini presents what appears to be a summary of Piccolomini's views. As it stands, Zabarella's charge appears ill-founded. However, Piccolomini's insinuation that it was Zabarella who had opened hostilities seems to be correct, for Zabarella had certainly been sharply critical of those who hold that *ordo doctrinae* should be based on the order *in rerum natura*, a view that he presumably well knew to be that of his senior colleague: see, e.g., *Opera logica*, cols 140-4, 183ff.

concentrating on the claims that especially threaten his own enterprise. Against Zabarella he insists that *ordo* must be grounded in the nature of things, and hence must be subservient to metaphysics rather than logic.[33] Natural order is either resolutive, according to the *ordo intentionis* which starts from the relevant goal or final cause, or compositive, according to the *ordo generationis* which starts with the simplest and most general principles.[34] The crux of Piccolomini's argument is the citation of instances in which the *ordo doctrinae* adopted by Aristotle is inexplicable in terms of cognitive *ordo* but is in evident conformity with the natural *ordo*.[35] Piccolomini concludes this part of his work by arguing that whilst the resolutive *ordo* used by Aristotle is appropriate to ethics as a whole, the compositive order that he is about to use in the body of the work is the one appropriate to *scientia civilis*, the theoretical part of ethics that teaches the principles underlying virtuous and just action.[36]

Zabarella responded promptly and at length in his *De doctrinae ordine apologia*.[37] He there rejects outright Piccolomini's charge of calumny, insisting that he has adhered strictly to the proprieties of philosophical debate, and implying that it is Piccolomini himself whose conduct is dishonourable. He defends himself at length on the issue of priority, pointing out that he had claimed originality only for the *ratio* of his claim that there are only two orders of doctrine, not for the claim itself.[38] He then reiterates his earlier views and takes Piccolomini's text apart point by point indicating ambiguity in his definition of *ordo* and inconsistencies and misinterpretations in his attempts to substantiate his account from the word of Aristotle.[39] Against Piccolomini he insists again and again that logic in general and *ordo* in particular are artificial instruments facilitating cognition of disciplines, indifferent to the natures of the things dealt with by those disciplines.[40] Further, he shows a particular concern to defend the boundaries and privileges of natural philosophy against incursions implied by Piccolomini's claims. Thus, he argues that natural philosophy is in no way dependent on metaphysics, even when their subject-matters overlap, since its *modus considerandi* is that of human reason, where the *modus considerandi* of metaphysics is revelation.[41] And in rebutting Piccolomini's case for the applicability of the compositive *ordo* in ethics he insists that ethics and medicine do not have theoretical parts, being purely operative disciplines directed by the human will towards an end—virtue in the case of ethics, health in the case of medicine—both disciplines being dependent on natural philosophy to the extent that their successful prosecution requires knowledge of principles.[42]

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[33] *Universa philosophia*, 35ff.

[34] Ibid., 42ff.

[35] For example, in ibid., 35-6, he argues that Aristotle's treatment of the senses in the sequence—sight, hearing, smell, taste, touch—follows the *ordo intentionis*, sight being the highest sense, whereas Averroes in adhering to the converse sequence follows the *ordo generationis*, touch being the most elementary sense; neither order being consistent with the *ordo cognitionis*.

[36] Ibid., 64.

[37] Venice 1584. I have used the version appended to the Cologne 1597, edition of his *Opera logica*.

[38] Ibid., cols 1-4 and 63-6.

[39] In particular, Zabarella is much concerned to refute Piccolomini's arguments based on sequences in Aristotle alleged to be incompatible with *ordo cognitionis*: ibid., cols 8-10, 14-20, 40-2.

Piccolomini had the last word, his *Comes politicus* being published just after Zabarella's death.[43] He there reiterates his earlier pronouncements on *ordo*. And he dismisses Zabarella's counterattack as the work of a "philologist rather than a philosopher"[44]—an abusive *retorquatio* of Zabarella's insistence on the crucial role of philology in the enterprise of philosophy, as one may gather from the *Universa philosophia* where we find: "those who are slaves to vices do not become philosophers but philologists (as Seneca says), that is, contentious, sophistical and ambitious men ...."[45] Piccolomini backs off his earlier implied claim for priority in recognising just two Aristotelian *ordines*, admitting that others had maintained this view before him, notably Girolamo Balduino—a shrewd thrust, since Zabarella's account of *ordo* is, indeed, very closely based on Balduino's.[46] His main new contributions to the controversy are: an elaboration of the earlier attack on Zabarella's conception of *ordo* as a logical *habitus*;[47] an amplification of his claims for the primacy of metaphysics, which reveals the divine plan and hierarchy of beings which underlie all *ordo*;[48] and a substantial defence of the credentials of a theoretical part of medicine properly taught using the compositive method.[49]

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[40] E. g., ibid., cols 8-31.

[41] Ibid., col. 30. Zabarella later treated this issue much more fully in his *De naturalis scientiae constitutione*, Venice 1586, chs 12 and 23 (in *De rebus naturalibus*, Frankfurt 1607-8, repr. Frankfurt 1966).

[42] *Apologia*, cols 78ff; *De naturalis scientiae constitutione*, chs 32 and 33.

[43] I have used the version appended to the Frankfurt 1627 edition of *Universa philosophia de moribus*.

[44] Ibid., 963.

[45] Ibid., 497; the reference is to Seneca, *Epist. mor.*, cviii.

V

We have seen how in the course of their dispute Zabarella and Piccolomini take up contrasting positions on the relations between philosophy and other disciplines—metaphysics, logic, ethics and medicine, for example. It is instructive to examine these differences concerning the *ordo* and *constitutio* of disciplines in more detail, for they reveal very different conceptions of the aims, nature and practice of philosophy. Under the Venetian protection philosophers at Padua enjoyed a substantial measure of freedom to adjudicate issues philosophically without reference to the revealed truths of metaphysics and theology. Equally unusually for the period, in philosophy, as in medicine and law, but in contrast to other arts subjects such as ethics and logic, it was possible to pursue a complete and lucrative career. This autonomy was of relatively recent origin, an achievement of the generation of Pomponazzi and Nifo, consolidated in the period of Zabarella's and Piccolomini's predecessors in office, Arcangelo Mercenario and Marcantonio Genua.[50] Both Zabarella and Piccolomini make large claims for the independence, dignity and edifying power of philosophy. But the conceptions of philosophy and of the *officium* of the philosopher that they convey in their writings and enact in their careers are very different.

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[46] Ibid., 1019ff; on Zabarella's debt to Balduino see G. Papuli, *Girolamo Balduino: ricerche sulla logica della Scuola di Padova nel Rinascimento*, Manduria, 1967.

[47] Ibid., 974ff.

[48] E. g., ibid., 968ff.

[49] Ibid., 1045ff; on this point Piccolomini appeals to the authority of his medical colleague Girolamo Capodivacca, referring to his *Opusculum de differentiis doctrinarum logicis, philosophis atque medicis pernecessarium*, Padua 1562, fol. 50v.

[50] See Facciolati (as note 25).

In this period it was the policy of the *riformatori* to drain other universities of brains, offering to foreigners the first ordinary professorships from which Paduans were barred. Piccolomini was a beneficiary of this system: called from Perugia to the first extraordinary chair of philosophy in 1564, he was promoted to the first ordinary chair only a year later. By 1589 he was almost certainly the best-paid philosopher in the world, with a regular annual salary of 1,000 fl. (enough to live in the manner of the minor local nobility), in addition to his earnings from extensive private tuition.[51] Zabarella, disadvantaged by his Paduan citizenship, had a less meteoric career, proceeding slowly via the chair of logic and the second and first extraordinary chairs of philosophy to the second ordinary chair, which he occupied from 1585 to his death in 1589.[52]

Zabarella's activities as a philosopher were precisely as indicated in his 1585 inaugural oration: copiously writing and lecturing on Aristotle's works in accordance with the University curriculum. Piccolomini was likewise expansive in his writings and punctilious in his lectures on the prescribed works of Aristotle. However, unlike Zabarella, he devoted much of his effort to private teaching of noble Venetian youths, expounding the works of Plato and expatiating Platonically on metaphysical, ethical and political issues.[53]

Zabarella and Piccolomini share certain basic assumptions about philosophy. Both envisage it as the domain of knowledge attainable by human reason unaided by divine revelation. Both are suspicious of novelties; for them philosophy is, above all, an interpretative enterprise directed at the recovery of lost or obscured knowledge through the minute study of the philosophical writing of Greek antiquity. However, the philosophies that they pursue and promote within this framework are very different.

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[51] On Piccolomini's life and teaching see A. E. Baldini, "Per la biografia di Francesco Piccolomini," in: *Rinascimento* 20 (1980), 389-420, and Lohr (as note 24), 331-42. On salaries in the Venetian Republic see Facciolati (as note 25) and B. Pullan, *Rich and Poor in Renaissance Venice*, Oxford 1971. Even by the more generous standards of the Florentine Court, to which Piccolomini in his latter years considered transferring his allegiance, his university salary was phenomenally high: see Biagioli (as note 23), ch. 2.

[52] On Zabarella's life and teaching see Edwards (as note 11), ch. 1, and Lohr (as note 24), 497-503.

[53] See Baldini (as note 51).

Perhaps the most evident differences concern the scope and form of philosophy. For Zabarella it is a strictly contemplative discipline, sharply distinct from such action-directed disciplines as ethics and medicine. Being the domain of unaided human reason, it is restricted to the study of nature, and specifically to the quest for knowledge of natural effects through their causes.[54] It is thus sharply distinct from metaphysics, which is entirely dependent on revelation. For Piccolomini the range of philosophy is vastly wider, covering the whole of metaphysics along with both the sciences of nature and *scientia civilis*, the theoretical part of ethics and politics.[55]

As we have seen, Zabarella seeks to recover obscured knowledge through interpretation of Aristotle's works guided by minute philological attention to textual detail and by the Greek commentators, supplemented when necessary by Averroes. In the bulk of his writing he adheres rigidly to a then standard "mixed" *quaestio-demonstratio* form, in which the *vera opinio* is confirmed and contrary opinions refuted using demonstration from *fundamenta*.[56] Piccolomini, by contrast, writes as a *conciliator*, out to find the core of sound doctrine variously expressed in the often apparently conflicting words of Plato, the deep philosopher, and Aristotle, the exact teacher.[57] Though he too employs a variant of the *quaestio* form in his writings, his argumentative strategy is very different, being much less devoted to refutation of the errors of the commentators, much more concerned with confirmation from a variety of sources. The discrepancy is nicely captured by their contrasting emblems—Zabarella's a book on a pedestal with the motto "Aristotelis omnia", "Aristotle in every respect", Piccolomini's the universe with the motto "Uno omnia", "All from one".[58]

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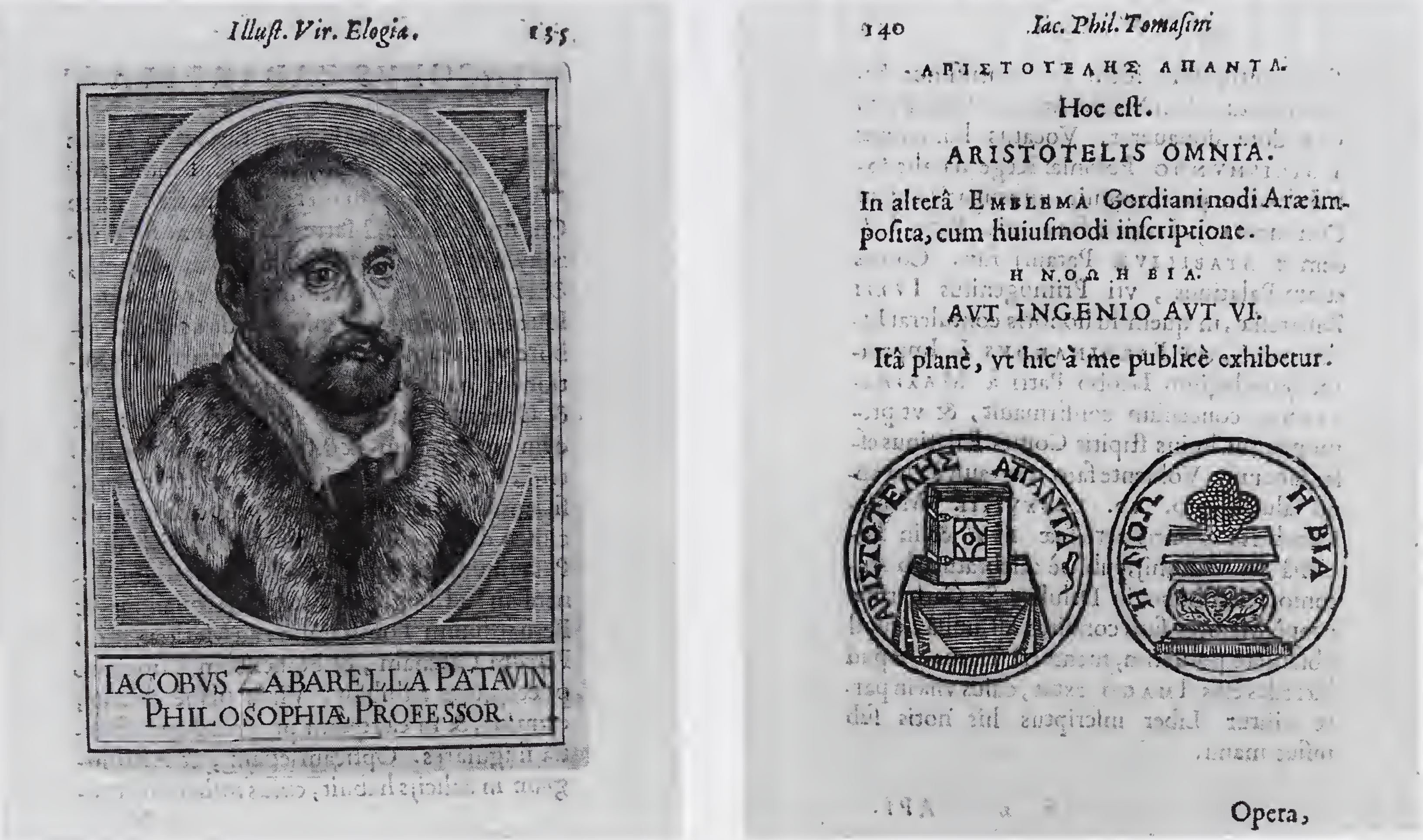
[54] *De naturalis scientiae constitutione*, chs 1-6.

[55] See especially the discussion of *philosophia inspectrix* in *Universa philosophia*, 3-4, 52ff, 483ff; also *Comes politicus*, 968ff.

[56] The mode of Zabarella's commentary is briefly treated in H. Schüling's discussion of types of commentary in his *Die Geschichte der axiomatischen Methode im 16. und beginnenden 17. Jahrhundert*, Hildesheim 1969, 29-34.

[57] On Piccolomini as *conciliator* and theorist of *conciliatio* see Poppi (as note 29), 124ff.

[58] From J. P. Tomasini, *Illustria virorum elogia iconibus exornata*, Padua 1630. For a comparable motto, *Emanat ab uno omnia*, and its emblem of the creation of the universe see A. Henkel and A. Schöne, *Emblemata. Handbuch zur Sinnbildkunst des XVI. und XVII. Jahrhunderts*, Stuttgart 1967, col. 18.



Illuſt. Vir. Elogia. 135

IACOBVS ZABARELLA PATAVIN
PHILOSOPHIÆ PROFESSOR.

140 *Iac. Phil. Tomaſini*

ΑΡΙΣΤΟΤΕΛΗΣ ΑΠΑΝΤΑ.

Hoc eſt.

ARISTOTELIS OMNIA.

In alterâ EMBLEMA Gordiani nodi Aræ impoſita, cum huiuſmodi inſcriptione.

Η ΝΟΩ Η ΒΙΑ.

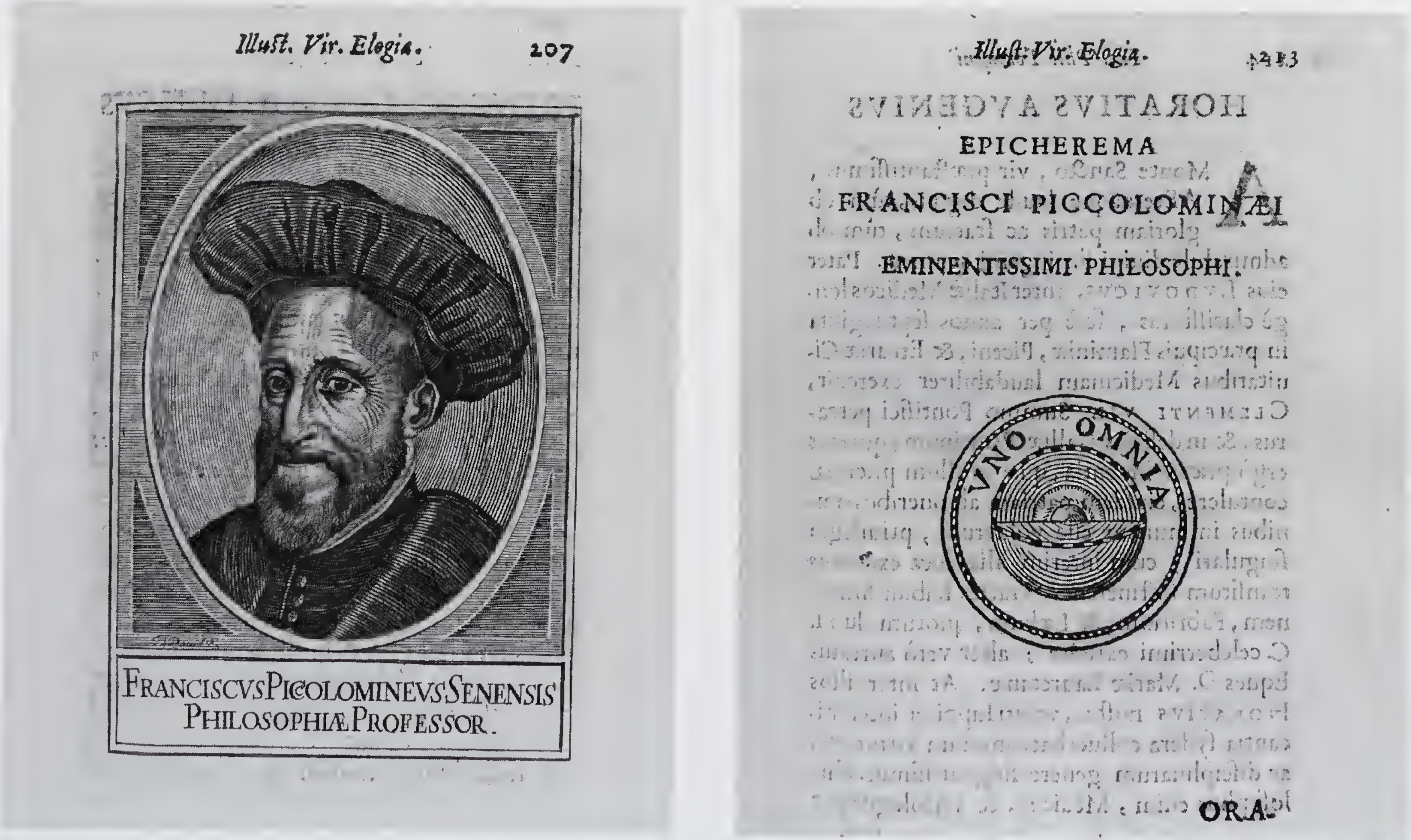
AVT INGENIO AVT VI.

Itâ planè, vt hic à me publicè exhibetur.

ΑΡΙΣΤΟΤΕΛΗΣ ΑΠΑΝΤΑ
Η ΝΟΩ Η ΒΙΑ

Opera,

Figure 2



Illuſt. Vir. Elogia. 207

FRANCISCVS PICOLOMINEVS SENENSIS
PHILOSOPHIÆ PROFESSOR.

Illuſt. Vir. Elogia. 213

EPICHEREMA
FRANCISCI PICCOLOMINÆI
EMINENTISSIMI PHILOSOPHI.

ORA-

Figure 3

Underlying these differences over the content of philosophy is a radical difference in their conceptions of the task and *officium* of the philosopher. Zabarella wholeheartedly endorses the purely contemplative nature of philosophy and the superiority of the contemplative life;[59] and he is frequently dismissive in his treatment of the disciplines he regards as active or operative—law, medicine, ethics and politics, mechanics. Piccolomini's stance is sharply opposed. For him, philosophy is, indeed, crucial for the spiritual perfection of man; but in the form of *scientia civilis* it is also the key to the this-worldly perfection that can be attained in the just administration of the Republic.[60] Evidence that this double role of philosophy lay at the heart of his private teaching comes from the writings of his aristocratic students, Nicolò and Tommaso Contarini, Stefano Tiepolo and Filippo Mocenigo. Though widely disparate in content and affiliation, their works show a common commitment to the view that philosophy transcends the apparent conflict between the contemplative and the active life, preparing men both for bliss in the afterlife and for this-worldly fulfilment in the service of the Serenissima.[61] On this crucial issue the divergence is again nicely conveyed by emblems. Zabarella's is a Gordian knot, the motto, "Aut ingenio aut vi," "Either by strength or by wit," opposing the active and the contemplative life to the advantage of the latter. By contrast the future Doge, Nicolò Contarini, Piccolomini's student and emulator, puts on the title page of his *De*

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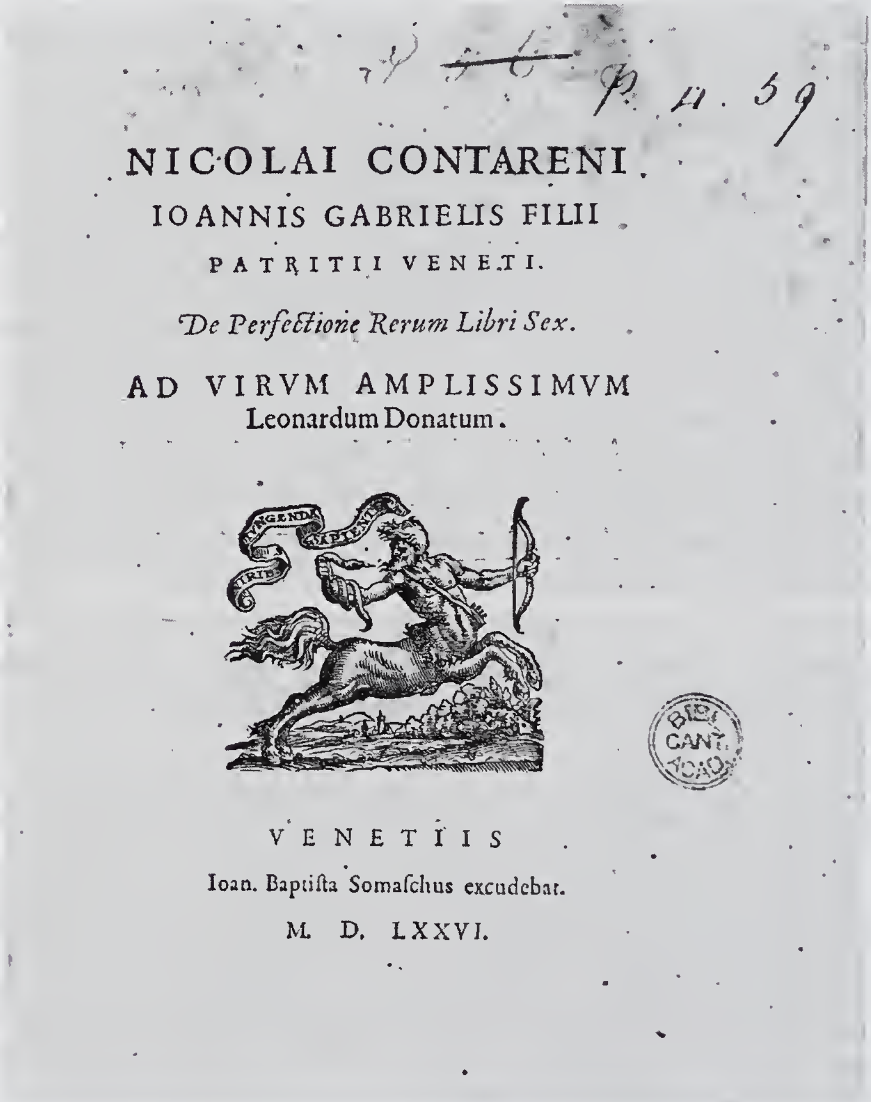
[59] See, for example, *Opera logica*, col. 97. There is a detailed treatment of this issue in Mikkeli (as note 11), ch. 2.

[60] On the active versus contemplative life in the period see, for example, P. O. Kristeller, "The active and the contemplative life in Renaissance humanism," in: B. Vickers (ed.), *Arbeit, Musse, Meditation: Betrachtungen zur Vita Activa und Vita Contemplativa*, Zurich 1985, 133-52; A. Poppi "Il prevalere della 'vita activa' nella paideia del Cinquecento," in: *Rapporti tra le Università di Padova e Bologna. Ricerche di filosofia, medicina e scienza*, ed. L. Rossetti, Trieste 1988, 97-125.

[61] See, e. g., Nicolò Contarini, *De perfectione rerum*, Venice 1576, introduction; Stefano Tiepolo, *Academicarum contemplationum lib. X*, Venice 1576, 200, where Plato's philosophy is said to transcend Aristotle's false contrast between the active and contemplative life; Tommaso Contarini (as note 30), fol. 35r, where the heroic virtue and *sapientia* are set on a par (though later the contemplative life is valued above the active: f.37r-v). On the writings of Piccolomini's aristocratic students and the vexed question of the extent of Piccolomini's contributions to them see E. Garin, *Giornale critico della filosofia italiana*, 15 (1961), Note e notizie, 134-6; A. Tenenti, "Il 'De perfectione rerum' di Nicolò Contarini," in: *Bollettino dell'Istituto di Storia della Società e dello Stato Veneziano* 1 (1959), 155-66.

perfectione rerum the centaur Chiron, tutor of both Achilles and Aesculapius, wielding the warrior's bow and the serpent of wisdom, with the motto "Viribus iungenda sapientia," "Wisdom to be combined with strength," celebrating the union of the contemplative with the active life.[62]


P. 11. 59

NICOLAI CONTARENI
IOANNIS GABRIELIS FILII
PATRITII VENETI.
De Perfectione Rerum Libri Sex.
AD VIRVM AMPLISSIMVM
Leonardum Donatum.

IVNGENDA SAPIENTIA
VIRIBVS

BIBL. CANT. ACAD.

VENETIIS
Ioan. Baptiſta Somaſchus excudebat.
M. D. LXXVI.

Figure 4

The divergence between the priorities of a public instructor and those of a tutor of potential rulers is evident also in Zabarella's and Piccolomini's views on the relations of philosophy to cognate disciplines: metaphysics, logic and ethics.

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[62] For more on the significance of this emblem see W. R. Dawson, "Chiron the centaur," in: *Journal of the History of Medicine* 4 (1949), 267-75; also Henkel and Schöne (as note 58), col. 1672.

Doubly protected against ecclesiastical censure, by the Venetian authorities and by the name of Aristotle, the Paduan philosophers had famously challenged the authority of revealed metaphysics and theology on many issues. Zabarella plays safe, acknowledging the primacy and supreme authority of metaphysics, and delimiting his own concerns in terms of his office, professor of an autonomous natural philosophy competent through the use of logic to seek out natural causes without recourse to revelation. Logic and ethics lay at the other extreme of the official Arts ranking, the poorly paid chairs of logic being first steps on the way to lucrative philosophy chairs, the often vacant chair of ethics being the worst paid of all Arts chairs (see Fig. 1).[63] Accordingly, Zabarella defines logic narrowly as the instrument of demonstration in the theoretical sciences, that is, in natural philosophy.[64] As for ethics, he construes it as a purely practical discipline, entirely dependent on natural philosophy for the principles of psychology on which it rests.

Where Zabarella sticks closely to the official disciplinary ranking and partition of territory, Piccolomini plays fast and loose. He shows no hesitation in risking conflict with orthodox revelation, presenting himself as a companion (*comes*) able to guide his noble students step by step up through natural and civil philosophy to his own very far from orthodox neo-Platonic metaphysics. As befits a guide to both the active and the contemplative life, he places the theoretical part of ethics on a par with natural philosophy. Moreover, he heatedly rejects Zabarella's instrumental conception of logic. For Piccolomini logic is the expression of man's highest faculty, reason, and it governs both the active and the contemplative domains.[65]

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[63] See A. Poppi (as note 29).

[64] It has been plausibly suggested that this is a defensive conception of logic, a response to the threat posed by the humanists' conflation of demonstrative logic with dialectic, probable argument, and their promotion of this expanded logic as an instrument of both practical and theoretical disciplines: see Mikkeli (as note 11), ch. 3; also A. Corsano, "Lo strumentalismo logico di G. Zabarella," in: *Giornale critico della filosofia italiana* 16 (1962), 507-17.

[65] See the section on Francesco Piccolomini of E. Kessler's "The intellective soul," in: C. B. Schmitt, E. Kessler and Q. Skinner (eds.), *The Cambridge History of Renaissance Philosophy*, Cambridge 1988, 485-534.

VI

In several passages of the *Nicomachean Ethics* Aristotle had compared ethics and medicine.[66] Piccolomini and Zabarella take up his analogy but to opposed ends. Zabarella uses the analogy to emphasise the operative rather than contemplative nature of both the general and the applied parts of ethics.

> Civics and matters of legislation are both directed to action, for which reason both can be called the medicine of the soul, but with this difference, that civics teaches the universal precepts, whereas legislation descends to particulars.[67]

For Piccolomini, on the other hand, medicine and ethics are analogous in virtue of their division into theoretical and applied parts, theoretical medicine relating to practical medicine as does civil science to the specificities of human action.[68]

The divergence between Zabarella and Piccolomini over the relation of natural philosophy to medicine is of great interest quite apart from its role in their dispute over the status of ethics. For the positions they take on this issue appear to reflect the threat posed by anatomy to the role of natural philosophy as the foundation of medical education.

At Padua in the preceding century the relation between medicine and natural philosophy had been extensively and often bitterly disputed. The history of these disputes is complex and has been ably dealt with elsewhere.[69] For our purposes a couple of points suffice. Throughout the period heated conflict was occasioned by the attempts of the medics to promote Galen over Aristotle as arbiter of issues of principle and order. In the middle decades of the sixteenth century the medics began to threaten the prerogatives of the natural philosophers more directly. There was a steady increase in anatomy teaching accompanied by a steady rise in its status—culminating in the promotion of Fabricius' chair of anatomy over the chairs of the natural philosophers in 1584, the year in which occasional anatomy lectures and human dissections were replaced by a regular half-year course and in which the first indoor public anatomy theatre (a mobile, temporary structure) was constructed.[70]

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[66] 1102a16ff, 1104a1ff, 1141a29ff, 1180b24ff.

[67] *De naturalis scientiae constitutione*, col. 102.

[68] *Universa philosophia de moribus*, 12-20.

[69] See, for example: C. B. Schmitt, "Aristotle amongst the physicians," in: A. Wear, R. K. French and I. M. Lonie (eds.), *The Medical Renaissance of the Sixteenth Century*, Cambridge 1985, 1-15; Bylebyl (as note 20); Mikkeli (as note 11), ch. 6.

It has recently been shown how in his published anatomical works Fabricius presented as the foundation for the whole of medicine a philosophical anatomy conceived in accordance with Aristotle's *Historia animalium*, *De partibus animalium* and *De generatione*.[71] Fabricius' philosophical anatomy was based on meticulous observation of the variety of structure of the parts of animals. Such observation showed how each normal part is so constructed as to enable it to perform its proper and healthy functions as an instrument of the soul. It showed also how divergences of parts from the typical form could be accounted for in terms of ill-health or special conditions of existence.

Despite their differences over the status of medicine and natural philosophy, Zabarella and Piccolomini are in certain respects close in their reaction to the philosophical pretensions of the medics. Thus they are united in their rejection of the medics' Galenical accounts of *ordo* and *methodus*, insisting against Galen that there exist only resolutive and compositive orders and methods.[72] And, crucially, they hold similar views of the status of Aristotle's *De partibus animalium.*

In the course of their extensive discussions of medicine, both Zabarella and Piccolomini repeatedly address the issue of the *ordo* of Aristotle's books on animate nature. Traditionally *De anima* had been placed first, the other dozen or so works being variously ordered after it. Marcantonio Genua, Zabarella's teacher and Piccolomini's predecessor in the first ordinary chair of natural philosophy, had placed *De anima* after both the *Parva naturalia* and the *Historia* and *De partibus animalium*.[73] Zabarella and Piccolomini defend an intermediate view, placing *Historia animalium* first, then *De partibus animalium* and *De incessu animalium*, then *De anima*, then *De generatione*, and finally the *Parva naturalia*.[74] They are further agreed that the books up to and including *De anima* are concerned with the internal principles of animate being, where the books following *De anima* deal with the particular *affectiones* and *conditiones* of animals consequent on the operation of those principles. Moreover, both identify the content of Aristotle's *De partibus animalium* as the part of natural philosophy most specifically relevant to medicine. Thus Zabarella writes:

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[70] See Favaro (as note 22); Bylebyl (as note 20). On Vesalius' pictorial strategies for raising the status of anatomy see G. Harcourt, "Andreas Vesalius and the anatomy of antique sculpture," in: *Representations*, 17 (1987), 26-61; also M. Biagioli, "Scientific revolution, social bricolage, and etiquette," in: R. Porter and M. Teich (eds.), *The Scientific Revolution in National Context*, Cambridge 1992, 11-54 (see 17).

[71] A. Cunningham, "Fabricius and the 'Aristotle project' in anatomical teaching and research at Padua," in Wear *et al.* (as note 69), 195-222, and the chapters on Fabricius and Venice in his *The Anatomical Renaissance*, Aldershot 1997. I thank Dr Cunningham for allowing me to read and draw upon a draft version of the latter work.

[72] Zabarella, *De methodis*, I, chs 1-3, II, chs 1-6 (in *Opera logica*); Piccolomini, *Universa philosophia*, 41-6.

> Immediately after the book concerning history there should be placed the four books concerning the parts of animals. ... Aristotle in those books deals demonstratively concerning parts, which he has not done in the earlier books covering history, in that he assigns four causes for each part, because the end of each part is the proper operation and proper function to which nature has directed that particular part as an instrument to an end. For all parts of the animal are instruments of the soul for performing various operations; moreover the nature of an instrument is best declared from its end. It is especially from this part of natural philosophy that the medical art takes that part that is called physiology, in which there is discourse of the human body and its parts, since knowledge of them is thoroughly necessary to the medic about to attend to them. Therefore medics who want to make an artful or fruitful anatomy should imitate Aristotle not in the books concerning the history, but in the books concerning the parts, dealing methodically with those parts.[75]

Association of *De partibus animalium* with medicine was not, of course, in itself a novelty. Galen, for one, in *De usu partium*, had paid tribute to the value of the work for a philosopher medic.[76] But this particular way of reading the work, and its association with a philosophical rather than a merely descriptive anatomy, appear to be both new and in substantial agreement with Fabricius.

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[73] *Aristotelis opera cum Averrois commentariis*, Venice, 1562-74, suppl. II, fol. 5r-7v: "De ordine librorum naturalium Aristotelis disputatio ex lectiones M. A. Passeri Ianuae excepta."

[74] Needless to say they offer quite different reasons. Thus Zabarella justifies the order up to *De anima* as being the order of a distinct cognition, from material principles accessible to the senses concerning the parts of animals to less accessible formal principles concerning the soul: *De naturalis scientiae constitutione*, ch. 32: "Divisio et ordo omnium librorum de Animalibus iuxta propriam opinionem." Piccolomini, on the other hand, sees this order as corresponding to the compositive order of generation in nature, which always proceeds from matter to form: *Libri ad scientiam de natura attinentium*, first publ. Venice 1596, Venice 1600, pars prima, f. 6r-v, 11r-16r.

[75] *De rebus naturalibus*, col. 93.

Fabricius' new anatomy can thus be seen to appropriate that very portion of natural philosophy judged by his natural philosopher colleagues to be fundamental to all sound medical teaching and practice. In effect, this new anatomy is presented as an alternative to natural philosophy as the foundation of medicine; and this alternative is offered in a university in which the primary role of natural philosophers is the training of medical students. It is no wonder that Zabarella, committed to the supreme value of contemplative philosophy and defensive of its university rights and privileges, is so insistent that Aristotle's *De partibus animalium* belongs to philosophy alone and that medicine is a purely practical art incompetent to establish causes and principles. No wonder that Piccolomini, committed to a philosophy at once active and contemplative and keen to promote his *scientia civilis* in the service of the State, is so happy to join forces with the medics in resisting the claims of the natural philosophers to sole jurisdiction over all issues of theory.

VII

I have argued that through their rival claims about *ordo doctrinae* Zabarella and Piccolomini reveal very different perceptions of academic and civil order and very different ways of conceiving and pursuing the office of philosopher within that order. In conclusion let me indicate some lines of research into questions of *ordo* that may prove profitable in the quest for a fuller understanding of the roles of philosophy in the sixteenth-century Venetian Republic.

Given the primacy of medical education in the Arts Faculty at Padua, an obvious priority for further research is fuller investigation of the ways in which Paduan medics treated issues of *ordo*. How did they order Aristotle's books on animate nature? How did they relate them to the more "philosophical" of Galen's works, for example, *De usu partium*? How did they conceive the relations between philosophical theory, on the one hand, and medical education and practice, on the other? Certainly Fabricius was not the only Paduan medic to make ambitious claims for a philosophical anatomy. Berengario da Carpi, for example, had long before presented a reformed philosophical anatomy as the foundation of medicine;[77] and similar claims were made also by Fabricius' contemporary Girolamo Capodivacca, holder of the second ordinary chair in practical medicine.[78] It remains, however, an open question whether such pretensions for anatomy represent merely an attempt to upgrade it from the lowly status of an operative and manual art, or whether there really was a serious and sustained attempt to remove natural philosophy from its privileged place in the medical curriculum.

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[76] See P. Moraux, tr. A. Preus, "Galen and Aristotle's De partibus animalium," in: A. Gotthelf (ed.), *Aristotle on Nature and Living Things: Philosophical and Historical Studies Presented to David M. Balme on his Seventieth Birthday*, Pittsburgh 1985, 327-44.

In this study I have concentrated on the roles of *ordo* in philosophical interpretation and exposition. *Ordo*, however, is for many of the Paduan philosophers and medics just one aspect of *paideia*, the theory and practice of education. Sperone Speroni, Alessandro and Francesco Piccolomini, Capodivacca, Cremonini, to name but a few, all wrote on *paideia*; and in doing so they related issues of *ordo* to questions of teaching method, bodily and spiritual cultivation and health, domestic and civic order.[79] Clearly, then, further investigation is needed in this wider context of educational theory.

Finally, and most importantly, the relations between philosophical activity and civil vocation would repay further study. In this connection, particular interest attaches to the natural philosophical, ethical, metaphysical and devotional works of the politically active *giovani* who paid tribute in their writings to the training in philosophy they had received at Padua.[80] Through study of their lives and writings it should be possible to understand Paduan philosophy not merely as a teaching activity patronised by the Venetian authorities, but as an integral part of Venetian civil life.

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[77] See R. French, "Berengario da Carpi and the use of commentary in anatomical teaching," in: Wear et al (as note 69).

[78] In his *De methodo anatomico liber*, Venice 1593. On Capodivacca see Mikkeli (as note 11), 156-9; *pace* Mikkeli, 159, Cunningham (as note 71) is, I think, right to emphasise the originality of Fabricius' proposals for an anatomy focused on organs of "the animal" rather than the organs of man.

[79] See, for example: Alessando Piccolomini, *Della institutione di tutta la vita dell'huomo nato nobile*, Venice 1542; Sperone Speroni, *Del modo di studiare. Discorso primo al signor Luigi Cornaro*, in *Opere*, Venice 1740, vol. 2, 486-502; Francesco Piccolomini, *Universa philosophia*, 403-10; Capodivacca (as note 49); Cremonini, *Tractatus de paidia*, Padua 1596. On the ideals of *paideia* in Speroni and A. Piccolomini see Poppi (as note 60). On *paideia* in Cremonini see M. A. Del Torre, "Logica ed esperienza nel trattato *De paidia* (1596) di Cesare Cremonini," in: *Aristotelismo veneto e scienza moderna*, ed. L. Olivieri, Padua 1983, ii, 637-45.

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[80] See the works cited at note 61; also, on the historical writings of the *giovani*, Bouwsma (as note 19) and G. Cozzi, "Cultura, politica e religione nella 'pubblica storiografia' veneziana," in: *Bollettino dell'Istituto di Storia della Società e dello Stato Veneziano* 6 (1963-4), 215-94.

THE FOUNDATION OF AN AUTONOMOUS NATURAL PHILOSOPHY: ZABARELLA ON THE CLASSIFICATION OF ARTS AND SCIENCES

Heikki Mikkeli

Introduction

At the beginning of his *Opera logica*, Jacopo Zabarella (1533-1589), the most outstanding of Paduan Aristotelians, draws a distinction between the eternal world of nature and the contingent human world. From this distinction he proceeds to two corresponding kinds of knowledge, and two distinct methods of defining them.[1] The Aristotelian distinction between arts (*artes*) and sciences (*scientiae*) serves as the starting-point for Zabarella's philosophical system.

Recent studies concentrate for the most part on Zabarella's work on logic; his philosophy of nature is often thought to be of less importance. He has been considered either as the culmination of Renaissance Aristotelianism, or as the precursor of modern science. Moreover, the methodology of science has been regarded as a separate problem which has little or nothing to do with other branches of philosophy such as metaphysics or the philosophy of nature—an interpretation which scarcely reflects what Zabarella and other Renaissance Aristotelians intended.

The purpose of the present article is to consider Zabarella's classification of different disciplines. For he was not concerned solely with the separation between the theoretical sciences and the practical and productive disciplines, but dealt also with the relationships and hierarchy among the theoretical sciences themselves. Thus it may be asked whether the hierarchy of knowledge which Zabarella promoted in the latter part of the sixteenth century was an attempt to establish a theoretical basis for an autonomous natural philosophy.

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[1] Zabarella, *De natura logicae (Opera logica)*, Cologne 1597; facsimile-print Hildesheim 1966, 2a-d.

Theoretical sciences and productive arts

Having made the primary distinction between arts and sciences, Zabarella proceeds to those sciences concerned with necessary things. Because sciences can be accessed only by contemplation, he calls them contemplative sciences. He divides these into three categories: divine science, which is also called metaphysics; mathematics; and natural philosophy. Zabarella notes that Aristotle requires two kinds of certainty from science. One is in the knowable things, which are necessary as such (*simpliciter)*; the other is in the mind of the scientist, who must be absolutely sure that things cannot be otherwise. We cannot know contingent or even necessary things unless our minds are certain that they cannot be different.[2]

According to Zabarella, there are different meanings of the word *scientia*. In the widest sense it includes all knowledge: so in this meaning all practical and productive disciplines can be called sciences. On these grounds medicine has sometimes been called a science. Like *scientia*, the word *ars* can refer to more than the productive disciplines; it may encompass active and contemplative philosophy as well. Zabarella himself, however, wants to employ the terms *ars* and *scientia* more restrictively. The use of the word *ars* is most comprehensive when it is extended even to the contemplative sciences, but less general and more accurate when it covers all disciplines except the contemplative ones. In Zabarella's view, the use of *ars* is most precise when it concerns only the productive arts, as Aristotle defined the word in the *Nicomachean Ethics*, VI,4.[3]

Zabarella emphasizes the hierarchical nature of the division between different disciplines; the whole of active philosophy aiming ultimately at the higher sphere of contemplation. It is beyond argument, according to Zabarella, that, both in Plato and Aristotle, happiness in the active life is not the ultimate goal for a human being. It is contemplation, which is man's finest objective, which may lead to total perfection.[4] The function of active philosophy is to remove hindrance to the acquisition of knowledge; contemplative philosophy is the ultimate end and master of all active philosophy. In productive disciplines it is not necessary to define the objects under production as strictly as in the contemplative sciences, because the productive arts do not aim at knowledge, and thus the knowledge they need do not have to be perfect.

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[2] Ibid., 4a-b

[3] Ibid., 17e-18a.

[4] Ibid., 97b.

In his collected works on natural philosophy Zabarella makes an interesting distinction between the arts involved in the process of shipbuilding. The art which produces the raw materials for a ship is the most useful, but nobody would call it architecture or art of quality. The art which builds a ship out of these materials is termed design and is highly respected, because the marine architect defines the ultimate appearance of the ship. The situation is similar in building a house. The art which produces the material is the lowest; the art of building is more highly respected than the first; but the noblest of all the arts involved is that which precedes the building process by designing the house. Architects do not participate in practical toil, but in assigning the appropriate tasks to each individual art their work is universal act.[5] According to Zabarella, therefore, the noblest arts are the most theoretical, not the most useful ones.

At the beginning of his *Opera logica* Zabarella's aim is to identify the basic difference between art and science. Science deals with what already exists, but art is concerned with creation. The subject-matter of a science is immutable, but the subject-matter of an art is the formation of things as yet non-existent, but which can be made by man. The contemplative philosopher is not interested in initiating anything, but rather wants to comprehend and arrange the forms of existing, eternal things. Moreover, the ultimate purpose of the contemplative sciences is the pursuit of knowledge for its own sake, but in the productive arts the end-result is an actual product.

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[5] Zabarella, *De rebus naturalibus*, Cologne 1590, 672d-e. In stressing the theoretical part of every art Zabarella follows Aristotle, who in the beginning of his Metaphysics (981a30-b2) says that the master-workers of each craft are wiser, more honourable and know in a truer sense than the manual workers, because the former know the causes of what is done. Also at the beginning of the Nicomachean Ethics (1094a7-18) he notes that arts can be placed in a hierarchy according to their goals.

The perfection of the philosophy of nature

In *De naturalis scientiae constitutione*, the first text in his collected works on natural philosophy (*De rebus naturalibus*), Zabarella deals in detail with the question of the perfection of the natural sciences. He claims, for example, that the book on minerals is necessary because the natural sciences would otherwise be incomplete. Whether Aristotle himself wrote about minerals is questionable, but later both Theophrastus and Albertus Magnus wrote on this important subject. The book on minerals in Aristotelian works on natural sciences follows immediately after the book *On meteorology*. In Zabarella's view, even if Aristotle himself did not write it, he at least realized the significance of the subject.[6]

So Zabarella did not consider Aristotle's works as a complete *corpus* to which nothing could be added. In *De methodis* he states that Aristotle wrote on subjects of his own choice, but it would be an exaggeration to claim that he was incapable of making mistakes. Aristotle was not infallible and it would be erroneous to insist that he knew the truth of everything he wrote. Nevertheless, he was an outstanding scholar, who turned the study of logic into a discipline.[7]

The last chapter of *De naturalis scientiae constitutione* is of special interest. Here Zabarella discusses the question of perfection and the order of the natural sciences (*De perfectione scientiae naturalis ac de eius ordine*). Aristotle's philosophy of nature may be perfect in structure and form, but it is incomplete in terms of its reference to natural beings. There is much that Aristotle did not discuss and indeed much that was outside his cognisance. Although he dealt comparatively little with plants and animals, it is not difficult to pinpoint their proper places in the Aristotelian system, and in his books on nature. Similarly, as regards mineralogy, it is easy to say that Aristotle himself wrote nothing on this subject, yet his system allows us to place Albertus Magnus' book on minerals immediately after the book on meteors.

> We can say that Aristotle's philosophy of nature is comprehensive in every respect as regards his subject-matter and what he includes—if not in practice, at least in theory. It may be observed that Aristotle omitted not only many things beyond his cognisance, but also familiar things he did not want to discuss. Certainly there is no book or treatise by Aristotle on the laughter of human

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[6] Zabarella, *De naturalis scientiae constitutione (De rebus naturalibus)* (as note 5), 76d-77a, 80d-e.

[7] Zabarella, *De methodis (Opera logica)* (as note 1), 331b.

> beings or on the neighing of horses or other similar things; however, he planted the seed and created the basis from which much he did not write about may be surmised. In contemplating these things we get a great deal of help from Aristotle's teachings, from which we may deduce knowledge.[8]

Zabarella compares Aristotle's natural science to the geometry and arithmetic of Euclid. There are many theorems which can be demonstrated from the latter's works even if he did not actually write them. Zabarella contends that this is no reason to judge Euclid's geometry or arithmetic defective or incomplete. If Euclid had wished, he could have demonstrated all these particular cases, but his book would have become so enormous that it would surely have daunted the reader. Zabarella suggests that this is why Euclid called his book *The Elements*, and from this foundation all the other theorems can be demonstrated.

In a parallel way Zabarella thinks that Aristotle's natural philosophy can be called perfect, since it deals with all the knowledge that it is possible for human intellect to obtain, either in practice or in theory.[9] The very idea of a complete science is apparent in Zabarella's logical works:

> I ask, what is natural science if not a perfect and distinct knowledge of natural beings through their causes? Scientific knowledge cannot be called confused or imperfect.[10]

This scientific ideal Zabarella presents is profoundly different from the modern view of a scientist making new discoveries. In his opinion, science can be "new" only in a very restricted sense; the work of a scientist is more like correcting the mistakes and filling the gaps in a ready-made Aristotelian world-system.

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[8] Zabarella, *De naturalis scientiae constitutione* (as note 5), 119d-e: "Sed dicere preaterea possumus, naturalem philosophiam ab Aristotele scriptam etiam ratione materiae ac rerum cognoscendarum perfectam et omnibus numeris absolutam esse, si non actu, saltem virtute. Quandoquidem credendum omnino est, non solum praetermissa ab Aristotele fuisse multa, quoniam ipse fuerunt incognita, sed omissa etiam ab ipso plura fuisse, quae novit, sed scribere noluit. Nam certum est, nullum ab Aristotele scriptum fuisse librum, vel tractatum de hominis risibilitate, aut de hinnibilitate equi, aut de aliis similibus; tamen fundamenta ac semina quaedam ab eo iacta esse, unde emanare etiam illorum, quae non scripsit, cognitio potest. Iis enim, quae nos Aristoteles docuit, adiuti possumus alia multa contemplari et in eorum notitiam duci."

[9] Ibid., 119f-120c.

[10] Zabarella, *De methodis (Opera logica)* (as note 1), 188e: "Quid enim, quaeso, est scientia naturalis, nisi perfecta et distincta rerum naturalium per suas causas cognitio? Confusa namque et imperfecta cognitio scientia dici non potest."

The role of the science of the soul

The hierarchy of different disciplines was a widely debated topic in the Renaissance. The famous dispute as to which discipline is nobler, law or medicine, had already begun in Florence at the turn of the fifteenth century. The discussion also spread to Paduan circles when Nicoletto Vernia published in 1482 a *quaestio* where he defended the nobility of medicine against law.[11]

The most influential section in the Aristotelian tradition, where the relationship between the theoretical or speculative sciences is dealt with, is the beginning of *On the Soul*. Aristotle opens his book with the following sentence:

> Holding as we do that, while knowledge of any kind is a thing to be honoured and prized, one kind of it may, either by reason of its greater exactness or of a higher dignity and greater wonderfulness in its objects, be more honourable and precious than another, on both accounts we should naturally be led to place in the front rank the study of the soul.[12]

Two criteria are given here for the hierarchy in different sciences: the dignity of their subject-matter and the exactness of their demonstrations. Referring back to Aristotle's opening, two major questions were raised in later commentary tradition. Firstly, what is the relationship between these different criteria, and secondly, in what place and on what grounds should the science of the soul be classified among the sciences.

In later commentary tradition two basic types of interpretation were adopted. On the one hand, later Greek commentaries and Thomas Aquinas considered Aristotle's first criterion to be the dominant one. According to this interpretation, the exactness of the demonstrations should be subordinated to the criteria of the dignity of the subject-matter.

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[11] Nicoletto Vernia, "Quaestio est, an medicina nobilior atque praestantior sit iure civili," in: E. Garin (ed.), *La disputa delle arti nel quattrocento* Florence 1947, 111-23. On Vernia's classification of sciences, see E. P. Mahoney, "Philosophy and science in Nicoletto Vernia and Agostino Nifo," in: A. Poppi (ed.), *Scienza e filosofia all'università di Padova nel quattrocento*, Padua 1983, 135-202, especially 155-8.

[12] Aristotle, *On the soul*, I 1 (402a1-5), tr. J. A. Smith, in: Jonathan Barnes (ed.), *The Complete Works of Aristotle*, Princeton 1984. Another significant section is in *Posterior Analytics*, I 27 (87a30-35).

On the other hand, another line of interpretation, stemming from Averroes, considered the two criteria as equal.[13]

The first line of interpretation is formulated very clearly in Thomas Aquinas' commentary on *De anima.* He mentions the two rival suggestions, but points out very firmly that the dignity of the subject-matter is the more valuable criterion.[14] He continues by referring to the fifth chapter of the first book of *Parts of Animals* (De partibus animalium), where Aristotle states that it is more worthy to understand something of nobler and higher matters than to know completely and with certainty the lower and less noble ones.[15] Thomas ends up by stating that the science of the soul fulfils both criteria perfectly: soul is a noble subject of which we can also acquire exact knowledge.[16]

The other major line of interpretation stems from Averroes' commentary on *De anima.* Averroes states that all disciplines differ from each other on two grounds: confirmation of demonstrations and nobility of subject-matter. Averroes also gives an example which becomes a commonplace among later commentators, namely the relationship between geometry and astrology. The demonstrations used in geometry are more exact, but the nobility of the subject-matter in astrology is higher.[17]

At the turn of the sixteenth century Pietro Pomponazzi makes use of Averroes' interpretation in his own exposition of the first chapter of *De anima.* Pomponazzi points out that some commentators have used the distinction between matter and form to settle the vexed question of nobility. The demonstrations are identified with *forma*, whereas the subject-matter of a science refers to *materia*. And because form is more noble than matter, the certainty of the demonstrations used in a science is a more noble criterion than the subject-matter.[18]

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[13] On the division between these two hierarchies, see L. Olivieri, "La scientificità della teoria dell'anima nell'insegnamento padovano di Pietro Pomponazzi," in: Poppi (as note 11), 203-22, especially 214-5.

[14] Thomas Aquinas, *In Aristotelis librum De anima commentarium*, eds. P. F. Angeli and M. Pirotta, Torino, s. a., 3: lect.I,1,I (3)

[15] Aristotle, *Parts of animals* 644b32-645a2.

[16] In the sixteenth-century commentaries Thomas' interpretation was widely accepted, as can be seen from the commentaries of Agostino Nifo and Arcangelo Mercenario. See Agostino Nifo, *Expositio subtilissima necnon et collectanea commentariaque in tres libros Aristotelis de anima* (Venice 1559), 4; and Arcangelo Mercenario, *In primum De Anima*, eds. L. Briguglio and E, Scapin, Venice/Rome 1961, 6.

[17] *Averrois Cordubensis commentarium magnum in aristotelis De Anima librum primum*, ed. F. S. Crawford, Cambridge, MA 1953, 3. However, the distinction between astrology and astronomy was not quite clear in Averroes' commentary.

Pomponazzi's own solution, however, is different. He develops two independent hierarchies of the sciences: the first is "the sciences as such" (*quoad naturam*), based on the ontological criterion, the other "sciences in relation to us" (*quoad nos*), based on the methodological criterion. Within these two different methods of organization, we also have two differing hierarchies of the sciences. In *scientiae quoad nos* there are three categories: mathematics is the most noble science, because the causes used in mathematics are perceptible. In the second place comes natural philosophy, of which only the effects are perceptible; and metaphysics takes the third place, because neither its causes nor its effects are perceptible.

But according to Pomponazzi, we can also form another hierarchy for *scientiae quoad naturam*, where metaphysics is considered the most noble science; natural philosophy comes in the second position; and mathemathics comes last.[19] Pomponazzi uses this division between the two hierarchies to clear up the apparent inconsistency between two passages in Aristotle's *Metaphysics*. In the first book Aristotle states that metaphysics is the most noble science,[20] but at the end of the second he elevates mathematics to this position.[21] The solution Pomponazzi offers is: the first time Aristotle is speaking about *scientiae quoad naturam*, but the second time he is referring to *scientiae quoad nos*.[22]

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[18] Pietro Pomponazzi, "Expositio super I "De anima" Aristotelis et Commentatoris," in: L. Olivieri (ed.), *Certezza e gerarchia del sapere*, Padua 1983, 177-86, especially 180.

[19] Ibid., 183-4.

[20] Aristotle, *Metaphysics*, 982a20-982b10.

[21] Ibid., 995a1-20.

[22] Pomponazzi (as note 18), 184. Two other Paduan professors, Federico Pendasio and Marcantonio Genua, repeated the division Pomponazzi had elaborated, but carried it no further. See Federico Pendasio, "Lectiones in libros de Anima," in: L. Olivieri (as note 18), 187-92, here 187, and Marcantonio Genua, *In libros de Anima commentarii*, Venetiis 1576, f.10r. At the turn of the seventeenth century Lodovico Carbone, a Jesuit professor at Collegio Romano, made use of the double criteria in his introduction to philosophical studies. In Carbone's view, the ranking according to certitude is almost the reverse of the ranking according to

Zabarella and the hierarchy of the sciences

In order to understand Zabarella's position we must first consider his concepts of the relationship between natural philosophy and metaphysics. He believes that natural philosophy aims at perfect understanding of natural effects through their causes, but metaphysics is entirely dependent on human revelation.[23] It is true that metaphysics could prove all the principles of other sciences. It does so, however, only in metaphysics, not in the realm of special sciences. So, for example, the principles of natural science must be proved through the principles proper to that science.[24]

In his commentary on *De anima*, published after his death, Zabarella raises the question of the hierarchy of the sciences. He states that many have said that the nobility of the subject-matter should be given precedence, because only then can absolute primacy be discussed. However, he says, the question is not as simple as that. In most cases the science with a nobler subject-matter can be considered superior, but not always. All human knowledge can be compared, and there are no grounds for giving either of these criteria absolute priority.[25] In his logical works Zabarella states that in the contemplative sciences, the nobility of the subject-matter should be considered superior to the causality of knowledge. Yet in logic, where the instruments of science are considered, the nobler instrument is the one which is more precise and produces more certain knowledge.[26]

As regards the certainty of the demonstrations there had been throughout the century a discussion about the correct translation of the Greek word *akribeia*. According to Zabarella, it had been traditionally translated into Latin as *certitudo* or *certus* (certain), but it should be

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nobility. In the latter scale mathematics is at the bottom, but Carbone considers it to be the most exact science in the other hierarchy. Lodovico Carbone, *Introductio in universam philosophiam*, Venice 1599, 258-61. See William A.Wallace, *Galileo and His Sources*, Princeton 1984, 130-2.

[23] See Nicholas Jardine's article in this volume.

[24] Zabarella, *De tribus praecognitis (Opera logica)* (as note 1), 529a-530a. In this respect Zabarella seems to have followed the opinion of Aristotle in *Physics* I, 1-2, and *Metaphysics* III, 2. On this point and on the different meanings of metaphysics, see G. Hatfield, "Metaphysics and the new science," in: D. C. Lindberg and R. S.Westman (eds.), *Reappraisals of the Scientific Revolution*, Cambridge 1990, 93-166, here 97-98.

[25] Zabarella, *In III libros De anima commentarii*, Venice 1605, col.8a-b.

[26] Zabarella, *De methodis (Opera Logica)* (as note 1), 327e-f.

translated as *exactus* (exact). What is known by senses is known with certainty, but perhaps not exactly, because it does not reveal the causes and the nature of things, and is thus incomplete. Knowledge is called exact, however, when it is not only certain, but also complete.[27] It is obvious that Zabarella wants to emphasize the nobility of demonstrative knowledge compared with knowledge obtained only through one's sense perception, which is not scientific at all.

Zabarella, then, did not want to give one decisive criterion according to which all arts and sciences could be arranged into one single hierarchy. However, when dealing with the place of the science of soul among the other natural sciences, Zabarella gives an interesting description of the nobility of this part of natural philosophy.[28] He states that Aristotle did not wish only to compare the science of soul with other sciences, but to compare it with other parts of natural science. Here it is obvious that the science of the soul is the most noble part of natural science, the king and emperor of every other part, which are all dependent upon it, because it shows the prime cause and the sum of everything that is in animals and plants. The science of the soul is more exquisite and certain than all the parts of natural philosophy because the causes of the science of the soul are more exact, not only according to us, but also according to nature.[29]

Zabarella's position here can be interpreted as an attempt to raise the status of independent natural philosophy by emphasizing the nobility of the science of the soul. In fact, it seems that he wanted to elevate the status of *De anima* to that of a special science among other natural sciences—the noblest and most precise of all natural sciences on which the other parts of natural philosophy could rely. What had earlier perhaps been considered to be part of metaphysics was now the most valuable part of natural philosophy.[30] The picture of Zabarella's position in Padua's intellectual climate becomes even sharper if we consider his view of the art of medicine and its relationship to the philosophy of nature.

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[27] Zabarella, *Commentarii in libros duos Posteriorum Analyticorum (Opera logica)* (as note 1), col. 981a-c. For the meaning of the word *akribeia* in Paduan commentary tradition, see the detailed discussion in L. Olivieri, *Certezza e gerarchia del sapere*, Padua 1983, 58-65.

[28] For the order of the natural sciences, see N. Jardine's article in this volume. On Zabarella's interpretation of the place of the science of soul, see also G. Movia, "Note sul primo capitolo del 'De anima' di Aristotele," in: *Scritti in onore di Carlo Giacon*, Padua 1972, 87-101, here 97-98.

[29] Zabarella, *In III libros De anima commentarii* (as note 25), col. 17d-e.

[30] On the role of *De anima* in the Renaissance, see Katharine Park and Eckhard Kessler, "The concept of psychology," in: C. B. Schmitt, E. Kessler and Q.

Philosophy of nature and medicine

Among the Paduan Aristotelians Zabarella was perhaps the author who discussed most thoroughly the relationship between the philosophy of nature and medical art. While in subject-matter these disciplines were close to each other, in their essence and methodology they were far apart. Zabarella did not consider medicine to be subalternated to the philosophy of nature, and nor did he see the distinction between theoretical and practical medicine as accidental; instead, he wanted to consider the whole art of medicine as operational. In spite of medicine's prominent place among the arts, Zabarella sharply denied its scientific status, and insisted that writers who claim that medicine is a science are mistaken. It is enough to admit that it is the noblest of all arts.[31]

In his *De natura logicae* Zabarella attacks writers who put medicine alongside the philosophy of nature among the sciences. Worse, many medical men even dare to consider medicine better than natural philosophy in terms of knowledge of the human body, simply because a physician treats it in a more specific way than a natural philosopher. Consequently they claim that medicine is necessary for philosophers so that they may treat all scientific things perfectly.

Zabarella feels that the situation is, in fact, quite the contrary. Contemplative philosophy appropriates nothing from the productive arts, though the arts adopt everything from philosophy. When intellectual cognition is said to be knowledge through its causes, this concerns only contemplative philosophy. Neither the art of medicine nor its singular parts can be considered as science. No matter how valuable and precise medicine may be, it could never be a science because it is practised not for the sake of knowledge, but for an end product: that is, the maintenance or restoration of health. If knowledge of the human body is considered purely for its own sake, rather than for curative purposes, it should be called natural science rather than medicine. Zabarella maintains that if a discipline is called medicine, it can no longer be called a science. Even if it were admitted that medicine could be practised for the sake of

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Skinner (eds.), *The Cambridge History of Renaissance Philosophy*, Cambridge 1988), 455-63.

[31] Zabarella, *De natura logicae (Opera logica)* (as note 1), 36d

knowledge, it could not be called a pure science, because it does not explain the first causes, and without this comprehension the other causes cannot be clearly apprehended.

The first, physiological part of medicine teaches us that a human being consists of four humours and four elements. It also deals with parts and uses of the human body, most of which are common to other, lower animals. Thus in contrast to other areas of medicine, physiology does not acquaint us with a human being primarily as a human being, but only as an animal among other animals. Galen and other medical writers should not be criticized because they wrote about medicine in the search for cures rather than for knowledge. Zabarella condemns instead those writers who place the art of medicine before the philosophy of nature, because there is nothing else valuable to learn about the human body that has not already been treated in natural philosophy.[32]

> If we consider within natural philosophy not only those things which have already been written, but also those which could be written and which belong to the perfect knowledge of all natural things understood by means of proper human reason, no additional help is needed from the art of medicine for attaining knowledge of these things. On the contrary a physician takes entirely from a natural philosopher all that is necessary for knowing and curing the parts of the human body.[33]

In *De methodis* Zabarella deals even more profoundly with the relationship between natural philosophy and medicine. The whole art of medicine—both the operative and the educational part—requires some foreknowledge of the subject-matter; that is the parts of a human body and their functions. Zabarella asks how a physician can cure a sick body if he does not know its parts.[34] The purpose of medicine is the maintenance of health and the recovery of it, if lost; however, in Zabarella's view, health cannot be fully comprehended and the goal cannot be achieved, if a physician does not comprehend all the parts of a human body and their nature, composition, purpose and function. He repeats that medicine lacks the perfection of natural philosophy because it does not deal with prime matter and substantial form.

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[32] Ibid., 60c-61d.

[33] Ibid., 61f-62a: "Propterea si naturalem Philosophiam non eam solum sumamus, quae scripta est, sed eam, quae scribi potest et quae rerum omnium naturalium perfectam cognitionem tradat, quantam homo proprio ingenio invenire et capere potest, illa nullo medicae artis auxilio indiget pro rerum cognitione adipiscenda, sed contra potius medicus a Philosopho naturali ea omnia sumit, quae pro cognitione partium humani corporis ab eo sanandi sunt ipsi necessaria."

[34] Zabarella, *De methodis (Opera logica)* (as note 1), 193e-194e.

What is even more interesting in Zabarella's discussion is his treatment of the ways foreknowledge of medical art can be acquired. He recognizes two different ways in which a physician can know the parts of a human body. Firstly, he may learn through perceptive knowledge and anatomical observations, thereby assimilating the matter of his discipline without understanding its rationale. Secondly, through philosophy of nature he may learn the reasons which lie behind what he sees. Zabarella thinks that Aristotle made the same distinction in his books the *History of Animals* and the *Parts of Animals*. In the first he relies on sense-perception to classify the different parts of animals. In the second, he offers causal explanations for what he is considering. In Zabarella's opinion this order of understanding results from our own inability to comprehend everything at once. It is thus better to progress gradually from confuse to distinct knowledge. Even the medical writers seem to admit, when they call the first part of medicine "physiology" (*fysiologiken*), that knowledge of all natural things and their causes belongs to the philosophy of nature, even though they do not emphasise the scientific nature of this approach.[35]

The question of the relationship between the philosophy of nature and medicine arises also in Zabarella's *De rebus naturalibus*, where he again points out that the art of medicine adopts the physiological part from the philosophy of nature. If medical writers want to know the anatomy of the human body, they must therefore follow Aristotle methodologically. Zabarella points out that they should not study the *History of Animals*, but the *Parts of Animals*, which methodologically shows us the functions of different parts of the bodies in question.[36]

The subject-matter of medicine involves maintaining or recovering health only in human beings, not in other animals. Since the whole discipline deals only with the human body it cannot be a science. Its subject-matter is, however, proper to the function and aim of an art. What a natural philosopher writes about animals, a medical writer should apply to human beings. Zabarella moves from the universal and scientific discussion of natural philosophy to a consideration of its particular aspects from the standpoint of operation, not knowledge.

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[35] Ibid., 196f-197f.

[36] Zabarella, *De naturalis scientiae constitutione (De rebus naturalibus)* (as note 5), 84b-c.

Zabarella believed that natural philosophy and medicine differ not only in their aims and subject-matter, but also in their methods. The resolutive method is proper to medicine and the compositive method is proper to the philosophy of nature. A physician does not use demonstrations or, if he does, he takes them from philosophy of nature. In medical art the resolutive order of presentation proceeds from knowledge to cure. The end, that is maintaining or recovering health, is broken down into principles, on which the operation is then based.[37] In the order of presentation Zabarella wants to differentiate between the presentation of a whole discipline and that of a part of it. For example, the first part of the art of medicine, physiology, has a compositive order as against medicine as a whole, which is arranged according to a resolutive order. This goes to show that physiology is not really medicine at all, but natural philosophy, because in physiology the nature of the human body is studied apart from operation.[38]

The nature of medical knowledge

In the middle of his logical writings, in *De methodis*, Zabarella also compares Galen's, Avicenna's and Averroes' treatments of the nature and definition of medicine as a discipline. He alleges that Galen well understood the nature of medicine. If a science is spoken of in the widest sense of the term to mean all human cognition, medicine can be called a science. Yet Zabarella feels that Galen's is not a proper definition of medicine, because it does not express clearly the nature and essence of medical discipline. Even if all arts are practised on the basis of some knowledge, their nature consists not of this knowledge, but of operation, to which the whole of knowledge is targeted. The fault of Galen's definition is that it does not speak of this operation at all. This is why Zabarella prefers Avicenna's definition, according to which medicine is cognition of the human body in the light of health and sickness. In this definition knowledge is connected to the final end of medicine, which is the maintenance of health, and of cure when health breaks down.

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[37] Zabarella, *De methodis (Opera logica)* (as note 1), 198a-e.

[38] Ibid., 222c-223a.

The best definition of all, however, is the one presented by Averroes. According to this, medicine is an operative art which proceeds from principles and aims at maintaining the health of the human body and curing its sickness. If we consider Galen's definition closely, we notice that it concerns the philosophy of nature rather than medicine. It is the natural philosopher who wants to know all natural beings, their accidental qualities, along with the symptoms and causes of their health or sickness.[39]

Zabarella suggests that Aristotle wrote a book of health and sickness of which nothing but a small fragment remains.[40] According to Zabarella, this treatise is not about medicine but about natural philosophy, because the knowledge of any natural things is part of the philosophy of nature, and no operation follows from this knowledge. When we aim at operation, the knowledge of natural beings belongs to an art, not a science.[41] There is a fine borderline between medicine and natural philosophy in their respective treatment of health and sickness. The difference lies in both subject matter and cause. Zabarella repeats that medicine confines itself to the health and sickness of human beings, whereas natural philosophy concerns itself with all natural beings. For example, a physician investigates herbs in order to maintain or restore health in the human body. A natural philosopher, however, treats herbs and plants quite differently, examining their nature and qualities in order to gain a perfect knowledge of them.[42]

Zabarella's conclusion about the relationship between the art of medicine and natural philosophy is that the latter must consider the universal qualities of health and sickness, while the former concentrates on finding remedies for particular diseases. Aristotle's fragment on health and sickness is therefore on the borderline between these disciplines. Zabarella sums this up: Where the natural philosopher ends, there the physician begins.[43] From the universal consideration of sickness and health the physician descends to the treatment of all particular diseases and to knowledge of their causes.

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[39] Ibid., 210e-211c

[40] Charles B. Schmitt has considered the question whether Aristotle really wrote any medical works. See Schmitt, "Aristotle among the physicians," in: A. Wear, R. K. French and I. M. Lonie (eds.), *The medical renaissance of the sixteenth century*, Cambridge 1985, 1-15, especially 2-3.

[41] Zabarella, *De methodis (Opera logica)* (as note 1), 211d.

[42] Zabarella, *De naturalis scientiae constitutione (De rebus naturalibus)* (as note 5), 90d-91a,117c-d.

Against this background it is difficult to understand the claim that Zabarella was the first sixteenth century Paduan writer to combine the medical and philosophical traditions after they had been divided for almost a century.[44] This line of interpretation has taken his methodology as a starting-point, but has paid no attention to the fact that he speaks about the relationship of medicine to natural philosophy in the middle of a work on methods. If we realize that his methodology is also used in order to illustrate the basic difference between these two kinds of disciplines, we reach a different conclusion. It is true that Zabarella agreed with Leoniceno, for example, in pointing out that Galen spoke about orders of presentation in his *Tegni*, but said nothing about research methods. Yet this approach misses the whole intention of Zabarella's treatment, which shows that his fundamental assumptions about the nature and role of theoretical and practical knowledge were quite different from those of the anatomists or medical commentators on Galen's *Tegni*.[45]

As we have seen, Zabarella did not appreciate any knowledge that could not fulfil the requirements of a science; and therefore medical art could never be a science. He considered that not only the subject-matter, but also the methods and aims of arts and sciences, were completely different. While discussing the principles of medical art Zabarella compares anatomical principles with the principles derived from natural philosophy. In his view, only the philosophy of nature, not anatomy, can provide a solid basis for medical practitioners. In this respect Zabarella cannot be considered as a precursor of modern experimental science.[46] Once again his confidence in the ability of human intelligence to produce necessary science—and in the relevance of this science as a principle of human practical endeavours—is evident.

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[43] Ibid., 91e-g. The proverb "ubi desinit philosophus, ibi incipit medicus" became very popular in the Renaissance. However, it received two contradictory interpretations, opting either for theoretical natural philosophy, or for medicine. See Charles B. Schmitt, "Aristotle among the physicians" (as note 40), 1-15, and Heikki Mikkeli, *An Aristotelian Response to Renaissance Humanism. Jacopo Zabarella on the Nature of Arts and Sciences*, Helsinki 1992, 131-3, 169-70.

[44] William F. Edwards, "Niccolò Leoniceno and the origins of humanist discussion of method," in: *Philosophy and humanism*, ed. E. P. Mahoney, Leiden 1976, 283-305, especially 302-3.

[45] On the concept of the nature of medical knowledge in Galenist *Tegni* (or *Microtechne* or *Ars parva* or *Ars medica*) commentaries and in anatomical treatises, see Mikkeli (as note 43), 131-59 (chapter 6).

The possibility of an independent natural philosophy

Charles Lohr, Eckhard Kessler and Nicholas Jardine maintain that at the University of Padua during the first part of the sixteenth century the possibility of an autonomous natural philosophy was developed. According to Lohr and Kessler, at the time of Pomponazzi the separation of metaphysics from natural philosophy made it possible to develop independent natural science. Lohr emphasized that it was not at the time of Galileo, but almost a century earlier, when the theoretical preconditions for an autonomous natural philosophy were created.[47] Jardine has emphasized that during the era of Marcantonio Genua and Archangelo Mercenario, a generation after Pomponazzi, the freedom to pursue a complete teaching career in different arts subjects emerged. Thus in the middle of the century the institutional preconditions for an independent natural philosophy were founded, too.[48]

In general, the history of natural philosophy in sixteenth-century universities should perhaps also be considered in the context of other arts and sciences. On the one hand, there were attempts to build up an autonomous natural science separated from metaphysics; and on the other hand, this natural philosophy had to answer the challenge that came from the productive disciplines. By this challenge I mean, for example, the attempt to replace speculative natural philosophy with practical anatomy as the starting-point of medical studies.[49]

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[46] Charles B. Schmitt, Nicholas Jardine and Paolo Rossi all come to roughly the same conclusion. Schmitt, however, lays more weight upon the observations Zabarella makes about natural processes; but as Rossi points out, these are not used as experiments in order to verify or falsify some idea, but only as an illustration of some Aristotelian point of view. See Charles B. Schmitt, "Experience and Experiment: A Comparison of Zabarella's View with Galileo's De Motu," in: *Studies in the Renaissance* 16 (1969), 80-138; Nicholas Jardine, "Galileo's Road to Truth and the Demonstrative Regress," in: *Studies in the History and Philosophy of Science* 7 (1976), 277-318, especially 314-5; Paolo Rossi, "Aristotelici e "moderni": le ipotesi e la natura," in: *Aristotelismo veneto e scienza moderna I.*, ed. L. Olivieri, Padua 1983, 125-54, especially 146.

[47] C. H. Lohr, "Metaphysics," in: Schmitt et al. (as note 30), 537-638, especially 604-5; ibid., "The Sixteenth-Century Transformation of the Aristotelian Natural Philosophy," in: E. Kessler, C. H. Lohr and W. Sparn (eds.), *Aristotelismus and Renaissance*, Wiesbaden 1988, 89-99; ibid., "The Sixteenth-Century Transformation of the Aristotelian Division of the Speculative Sciences," in: D. R. Kelley and R. H. Popkin (eds.), *The Shapes of Knowledge from the Renaissance to the Enlightenment*, Dordrecht 1991, 49-58. E. Kessler, "The intellective soul," in: Schmitt et al. (as note 30), 485-534.

[48] See Nicholas Jardine's article in this volume.

This and other similar developments, in the field of mathematics for example, make the eagerness to build up various orders and hierarchies in Renaissance Aristotelian commentaries more comprehensible. Moreover, the interminable discussion of the methodology of arts and sciences in the sixteenth century may be seen as an attempt to defend the scientific status of either the recently founded autonomous sciences, or, on the other hand, the empirically based productive arts. The discussions of orders and methods, resolutions, compositions and *regressus* are, therefore, not merely further elaborations of an old Aristotelian tradition; but also expressions of opinions in a lively debate concerning the changing relationships between various arts and sciences in sixteenth-century Italian universities.

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[49] On this point, see Jardine's article in this volume and chapter 6 of Mikkeli (as note 43).

GALILEO'S REGRESSIVE METHODOLOGY, ITS PRELUDE AND ITS SEQUEL

William A. Wallace

In this essay I discuss Galileo's understanding of regressive methodology as it is set forth in two of my books[1] that provided *entrée* to the theme on which this volume of essays is based, namely, "Method in Sixteenth-Century Aristotle Commentaries." The exposition is basically autobiographical, for I begin with a brief account of my research on two Dominican friars, Dietrich von Freiberg and Domingo de Soto, whose writings led me to studies of Galileo's methodology. This is the "prelude" of my title. I also conclude with a "sequel" in which I offer a few reflections on how Galileo's methods bear comparison with those of two English scientists in whom I have been interested, William Harvey and Sir Isaac Newton. In this way I hope to cast light on Aristotelian methodology not only as it was developed in the sixteenth century but also as it was understood in centuries previous as well as the famous century that followed.

Prelude

Jacopo Zabarella pointed to chapter thirteen of the first book of the *Posterior Analytics* as the place where Aristotle first introduced the demonstrative *regressus*, though not explicitly by that name.[2] Oddly enough Dietrich von Freiberg cited the same chapter of the *Analytics* in introducing his treatise on the rainbow, *De iride*, written between 1304 and 1311, wherein he proposed to follow Aristotle's canons.[3] The *De iride* is very important for the history of science, for in it, *pace* Descartes and Newton, Dietrich was the first to work out a correct explanation of the primary rainbow, demonstrating its various properties from its causes as he had found these out by experimental investigation. The formal cause is its appearance in the heavens, fixed by measurable parameters, the efficient cause is light radiated from the sun or other heavenly body, and the material cause is the collection of spherical raindrops in which the light rays are reflected and refracted according to optical laws to produce the rainbow's appearance in the eye of the observer. In my 1959 analysis of this work I showed how Dietrich used the twofold Aristotelian method, the *via inventionis* and the *via judicii*, first to discover the causes of the rainbow and then to use them to demonstrate its properties.[4] Thus his was a "logic of discovery and proof," essentially the same as the logic I have now attributed to Galileo.[5] Unfortunately Dietrich's work lay in manuscript for centuries, was not mentioned in print until 1514, and was not transcribed and published until four hundred years later, in 1914. A critical edition finally appeared in Dietrich's *Opera omnia*, edited between 1983 and 1985.[6]

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[1] *Galileo's Logic of Discovery and Proof* and *Galileo's Logical Treatises*, cited below in notes 5 and 16 respectively, which were provided to participants of our 1992 Wolfenbüttel seminar by the Foundation for Intellectual History.

[2] This was in his commentary on Book 1 of the *Posterior Analytics* in the passage where Aristotle is discussing the non-twinkling of planets and the phases of the moon, which Zabarella identifies as chapter 12 rather than 13. Zabarella has the marginal note *Regressus* at this passage; see his *Opera logica*, Cologne 1597, cols. 836-40, at col. 839A; see also col. 836E-F.

Following that study in late medieval optics and a five-year term as one of the editors of the *New Catholic Encyclopedia*,[7] I began to work on Renaissance mechanics in 1965. I did so at the suggestion of Professor I. Bernard Cohen of Harvard University, who was aware of the fact that a Spanish Dominican, Domingo de Soto, had enunciated the correct law of falling bodies around 1550, some eighty years before Galileo, and thought that someone with my background should study that further. So I worked with Cohen at Harvard until 1967, by which time I had assimilated what was then known about the *Calculatores* at Oxford, the *Doctores Parisienses*, and John Herman Randall's "School of Padua," and had started to flesh out the calculatory tradition on the Iberian peninsula, particularly at Salamanca.[8]

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[3] See his *De iride et radialibus impressionibus*, ed. Joseph Würschmidt (Beiträge für Geschichte der Philosophie des Mittelalters 12/5-6), Münster 1914, 36.

[4] *The Scientific Methodology of Theodoric of Freiberg. A Case Study of the Relationship Between Science and Philosophy* (Studia Friburgensia, New Series 12), Fribourg 1959, 174-248.

[5] In my *Galileo's Logic of Discovery and Proof. The Background, Content, and Use of His Appropriated Treatises on Aristotle's "Posterior Analytics"* (Boston Studies in the Philosophy of Science 137), Dordrecht/Boston 1992.

[6] In: *Corpus Philosophorum Teutonicorum Medii Aevi*, series II, 4 vols., ed. K. Flasch, vol. 4, (M. R. Pagnoni-Sturlese et al., eds), Hamburg 1985, 95-268.

[7] W. J. McDonald et al. (eds.), 15 vols., New York 1967, with supplementary volumes in 1974, 1979, and 1989.

In Soto's terminology a motion that is uniformly accelerated in free fall is described as *uniformiter difformis*, so I canvassed every occurrence of that expression I could find in sixteenth-century manuscripts and books, first following a trail left by Pierre Duhem and then striking out on my own.[9] Alexandre Koyré had posed what he called "the enigma of Domingo de Soto," namely, how Soto came to associate *uniformiter difformis* with the motion of falling bodies.[10] Having worked that out fairly well, I started on "a second enigma," how Soto's finding might have been transmitted to the young Galileo.[11] It just happened that Galileo mentions Soto in his early Latin manuscripts, written around 1590, one of which contains the *De motu antiquiora*, his early treatise on motion, and that seemed worth looking into.[12]

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[8] The results of that work are summarized in my *Causality and Scientific Explanation*, Vol. 1: *Medieval and Early Classical Science*, Ann Arbor 1972.

[9] See my "The Enigma of Domingo de Soto: *Uniformiter difformis* and Falling Bodies in Late Medieval Physics," in: *Isis* 59 (1968), 384-401, enlarged and reprinted in my *Prelude to Galileo: Essays on Medieval and Sixteenth-Century Sources of Galileo's Thought* (Boston Studies in the Philosophy of Science 62), Dordrecht/Boston 1981, 91-109, cited more fully in note 13 below. Duhem's ground-breaking work here is his *Études sur Léonard de Vinci*, 3 vols., Paris 1906, 1909, 1913. Fuller details of Soto's teaching are given in my "Domingo Soto's 'Laws' of Motion: Text and Context," in: E. Sylla and M. McVaugh (eds.), *Texts and Contexts in Ancient and Medieval Science: Studies on the Occasion of John E. Murdoch's Seventieth Birthday* (Brill's Studies in Intellectual History 78), Leiden 1997, 271-304.

[10] In the second volume of R. Taton's four-volume history of science, *The Beginnings of Modern Science*, tr. A. J. Pomerans, New York 1964, in Koyré's entry on "The Exact Sciences," 94-95.

[11] Preliminary results are reported in my "The Early Jesuits and the Heritage of Domingo de Soto," in: *History and Technology*, 4 (1987), 301-320, reprinted in my *Galileo, the Jesuits and the Medieval Aristotle* (Collected Studies Series 346), Aldershot, 1991. See also my "Domingo de Soto and the Iberian Roots of Galileo's Science," in: K. White (ed.), *Hispanic Philosophy in the Age of Discovery*, Washington, D.C., 1997, 113-29

[12] The citations may be found in my *Galileo's Early Notebooks: The Physical Questions. A Translation from the Latin, with Historical and Paleographical Commentary*, Notre Dame 1977, 208, 210.

Unraveling that second enigma has taken quite a long time, and in some ways it is still not solved completely. A key figure has turned out to be Franciscus Toletus, who was Soto's favorite student at Salamanca. Toletus later joined the Jesuits and was sent to Rome to teach philosophy at the newly formed Jesuit university, the Collegio Romano. His teaching there was very influential. Tracing that influence has helped greatly toward understanding not only Galileo's mechanics but also the methodology with which he made the discoveries he did. The path I travelled has been documented in a series of books, among which the more important are *Prelude to Galileo*[13] and *Galileo and His Sources.*[14] But the most fruitful line of investigation came when I fixed unambiguously the source of Galileo's logical questions, and was able to publish, with William F. Edwards, the transcription of the Latin manuscript containing them.[15] That is the manuscript now available in English translation, entitled *Galileo's Logical Treatises.*[16] The introduction to that volume sketches all that was known about Galileo's Pisan manuscripts at the time of its writing. The companion volume, titled *Galileo's Logic of Discovery and Proof,*[17] explains the entire logic course from which Galileo's notes were appropriated, and how I see that logic as having informed Galileo's science throughout his lifetime.

Looking over the impressive bibliography Professor Kessler assembled for our seminar awakened in me a feeling of nostalgia, for in my searches through European libraries I have come across many of the books on his list. Countless times I have checked out volumes and then looked through them for expressions that might provide the key to my enterprise. Some of these have shown up in the titles of my writings: *uniformiter difformis*, *Doctores Parisienses*, *regressus demonstrativus, demonstratio ex*

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[13] *Prelude to Galileo* (as note 9).

[14] *Galileo and His Sources: The Heritage of the Collegio Romano in Galileo's Science*, Princeton 1984.

[15] Galileo Galilei, *Tractatio de praecognitionibus et praecognitis* and *Tractatio de demonstratione*, transcribed from the Latin autograph by W. F. Edwards, with an introduction, notes, and commentary by W. A. Wallace (Università di Padova, Centro per la Storia della Tradizione Aristotelica nel Veneto, Saggi e Testi 22), Padua 1988.

[16] *Galileo's Logical Treatises. A Translation, with Notes and Commentary, of His Appropriated Latin Questions on Aristotle's "Posterior Analytics"* (Boston Studies in the Philosophy of Science 138), Dordrecht/Boston 1992.

[17] As note 5.

suppositione; others, *praecognitio, instrumenta sciendi, resolutio et compositio, impedimenta*, were signposts for which I looked. But I must say it was always like looking for a needle in a haystack, and many times I despaired of ever finding anything. Galileo's Pisan writings were in manuscript, and the more I worked the more I became convinced that he himself had worked from manuscript sources, so that it was not so much in books but in other manuscripts that I would find the connections for which I looked.[18] I shall return to that possibility and its effects on our project toward the end of the essay.

Regressive Method in the *Physics*

In his introduction and in his essay in this volume Professor Kessler has put his finger on the key problem the foregoing work poses for anyone studying method in sixteenth-century Aristotle commentaries. I have recognized the problem myself in the context of Galileo studies, first when asking how the teachings in MS Gal. 27 relate to those in MSS Gal. 46 and 71 and then when searching for Galileo's *logica utens* throughout the broader range of his writings. The basic problem is the tie, if any, that exists between Aristotle's logic and his physics, between the method he articulates in the *Posterior Analytics* and the way he puts that method to use in the *Physics, De anima,* and *De partibus animalium.* The problem can be posed in the context of the Greek Aristotle, where some scholars, such as Jonathan Barnes,[19] would deny that any such tie exists, or in the context of the Renaissance Aristotle, which was the project for our seminar. More proximately the question can be raised whether this tie existed among the Jesuits of the Collegio Romano in the late 1580's, or even in the works of Galileo's principal source, Paulus Vallius himself. Here I shall attempt to answer those relating to the Jesuits in general. With regard to Vallius, although I have studied his *Logica* I have not had access to his *Physica*, so I will have to postpone a reply until that opportunity presents itself.[20] But I do have copies of the physics courses taught by Toletus and Antonius Menu, who taught them at the Collegio prior to Vallius, and by Mutius Vitelleschi and Ludovicus Rugerius, who taught them immediately after him. My study of all four yields an affirmative answer: there was such a tie, though it is not stated so explicitly as to make it apparent on cursory reading.

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[18] Details are given in my "Galileo's Sources: Manuscripts or Printed Works," in: G. B. Tyson and S. Wagonheim (eds.), *Print and Culture in the Renaissance: Essays on the Advent of Printing in Europe*, Newark, Delaware 1986, 45-54.

[19] "Aristotle's Theory of Demonstration," in: J. Barnes et al. (eds.), *Articles on Aristotle: 1. Science*, London 1975, 65-87, revised from an earlier version in *Phronesis* 14 (1969), 123-152.

The burden of my essay is to review the evidence in those lectures that leads me to that conclusion. For the benefit of those who might experience difficulty with the Latin in which they were given, rather than give the original texts (which are available in the sources I cite), I have translated or paraphrased all of their teachings into English.

Toletus

As has already been mentioned, Franciscus Toletus is important as a link between Galileo's logic and the eclectic Thomism of Domingo de Soto as this was taught at the University of Salamanca. Toletus is also important for publishing the course in philosophy he gave in his early years at the Collegio Romano, among which his *Physica* and *Logica* are relevant for us.

In his commentary on the *Physics* Toletus discusses the mode of proceeding in that discipline in Book 1, chapter 4, where he begins with a review of what Averroes says on the subject. He writes:

> Concerning the natural mode of proceeding, Averroes says that this is in the manner of a discipline and in a demonstrative way. By "in the manner of a discipline" he means the facile and familiar way of proceeding, which is by induction, example, division, and hypothetical syllogism; by "demonstration" he means the three kinds of demonstration, for these include demonstration of a sign, demonstration of a cause, and demonstration in an unqualified way (*simpliciter*). A demonstration of a sign takes place when we demonstrate something *a posteriori* through signs and effects. A demonstration of a cause is a demonstration that proceeds through a cause, but its effect is already known before the cause, as when one first knowing of an eclipse inquires into its cause

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[20] Although Charles Lohr lists Vallius' *Physica* as having been printed at Lyons in 1624, and although a censorship report on the manuscript dated 18 September 1621 is preserved in the Roman Archives of the Society of Jesus, there is some doubt as to whether this work ever appeared in print. It is noteworthy that a similar censorship report on Vallius' *Logica* approved it for publication on 24 June 1612, but that book was not published at Lyons until 1622. Since Vallius died in 1622, it could be that plans for the publication of the *Physica*, originally scheduled for 1624, were abandoned after his death. See *Galileo and His Sources* (as note 14), 17-18.

> and then through this cause proves it as an effect; such a demonstration only manifests the cause, and does not prove that the effect exists. On the other hand, when the effect is not known before the cause but is first known when grasped through the cause itself, the demonstration is said to be in an unqualified way because it proves the effect and manifests the cause at the same time.[21]

The natural philosopher, Toletus goes on, uses all three types, but the first and second types more frequently because physical effects are more known to us than are their causes. He then ties in this remark with his logic course, saying that he will give an extensive explanation of it in his exposition of the first book of the *Posterior Analytics* and then stating explicitly that for this "the *regressus* is required." As can be seen from Toletus' statements that follow, there is no doubt in his mind that logical doctrine is relevant to work in natural philosophy:

> The philosopher uses all three types of demonstration, but more frequently demonstration of a sign and of a cause because physical effects are more known to us than their causes. We will give an extensive exposition of demonstration of a cause in our exposition of the first book of the *Posterior Analytics*. For I also think, since the effect is known previous to the cause, that the demonstration proves that the effect exists, because the effect is known *particulariter* before the cause, but not with such necessity that, when it is proved through the cause, it is known *universaliter* and necessarily. And for this the *regressus* is required, so that we might come to know most perfectly an effect that otherwise is known imperfectly. Still a twofold demonstration is to be distinguished, both the one that proves through a cause an effect previously known in some way and the one that proves the existence of an effect that is previously unknown in any way, granted that every demonstration that is made proves the effect's existence if it proceeds through a cause. Thus much of the mode of proceeding [fol. 6va].

Turning to Toletus' *Logica* we find the promised exposition of the demonstrative *regressus* in chapter 3 of Book 1 of his commentary on the *Posterior Analytics*, which is devoted entirely to the problem it poses.[22] Toletus formulates the problem of how demonstration is employed in the regress as follows:

> To this difficulty some moderns reply by distinguishing two kinds of demonstration: *propter quid*, from Averroes, second *De caelo* comm. 31 and eighth *Physics* comm. 65; and another which is both of cause and existence, that is, through which we show the cause of the effect and at the same time prove the effect to exist, as when from causes more known to us we proceed to

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[21] Franciscus Toletus, *Commentaria una cum quaestionibus In octo libros Aristotelis De Physica Ausculatione, nunc quinto in lucem edita*, Venice 1600, fol. 6rb-va.

[22] Franciscus Toletus, *Commentaria una cum questionibus In Universam Logicam Aristotelis*, Venice 1584.

> hidden effects, and this is most powerful (*potissima*). There is another that shows only the cause of the effect but not the latter's existence, and this is demonstration of the cause. And so they admit that a *regressus* is made from a cause to an effect previously known as to its existence, but the *regressus* shows the cause according to which the effect was previously unknown.
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> And although this opinion is not to be rejected, it seems to me that one can respond differently and more to the mind of Aristotle, especially from the opinion of St. Thomas, second *De caelo* 59, where he also defends Alexander against Simplicius and explains the proper force of the demonstrative *regressus*. I say therefore that every demonstration proves the effect to exist and at the same time manifests the cause, which Themistius concedes without argument, second *Posterior Analytics*, chap. 2. Therefore note, as we said above, that although the existence of the effect is known before the cause, this is imperfectly and particularly. But after the demonstration we know the effect universally and more certainly and more clearly; Aristotle teaches this expressly in the first *Posterior Analytics*, chap. 24, where he says that even though we might see that a triangle has three angles we still seek a demonstration, because we would not know this universally except through a demonstration. On this account a demonstration always proves the effect to exist, although with a distinction, for sometimes some foreign and imperfect knowledge of the effect comes before. You say: if such knowledge of the effect is imperfect and particular, since it is through this that we arrive at the cause, the knowledge of the cause will also be imperfect. I say: not so, for such knowledge of the cause was the way to discovering the cause; moreover, once the cause has been found, and through other speculations of the intellect, we know the cause more perfectly. Thus it comes about that through the cause we make the regress to knowing universally the effect that was unknown before the cause. And this is what I think about the *regressus* [fol. 167va].

Thus, in the case of Toletus, we have a clear recognition of the use of the *regressus* in natural philosophy, and complementary explanations of regressive methodology in his expositions of both the *Physics* and the *Posterior Analytics.*

Menu

For Antonius Menu we do not have the notes from his logic course but we do have those of his entire course on natural philosophy, including that on the *Physics.*[23] Like Toletus, Menu has a brief exposition of the order or method to be observed in natural philosophy; this is found in his prologue to the study of natural philosophy. The method for him is twofold: one is the way of discipline, the order of proceeding in the subject matter, the other is the way of doctrine, the order of proof to be followed in doing so. The order of treatment is in general that sketched by Aristotle in the first book of the *Physics*, that is, from the more universal to the less universal, from principles to causes to properties, and, when treating principles, from the more general and most common to those that are particular. The order of proof, for Menu, is basically one that uses the various types of demonstration sketched by Toletus and explained in the *Posterior Analytics*, though Menu does not name that work nor does he mention the *regressus* in describing the process of discovery and proof. He writes:

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[23] Antonius Menu, *Quaestiones in philosophiam naturalem datae a Reverendo Patre Antonio Maria Menu Societatis Iesu Sacerdote*, anno 1577, 20 Octobris, Romae, [In libros Aristotelis Physicorum] ... In libros Aristotelis De caelo ... [In libros Aristotelis De generatione] ... [Metaphysica] ... [Colophon:] 6 Octobris 1579, Ueberlingen, Leopold-Sophien-Biblithek, Cod. 138. There is no foliation in this manuscript. Our interest here is in Menu's prologue to the study of natural philosophy, with which the manuscript begins. This is divided into five chapters, entitled respectively 1. Whether there is a science of natural things; 2. On the

> Concerning the method that is to be observed in the parts of natural philosophy, that method is twofold. One is the way of doctrine, and this is nothing more than the order of proof that is followed in the sciences. Another is said to be the way of discipline, which is the mode of proceeding in the doctrine itself.
> The mode of proceeding in the *Physics* is in general from the more universal to the less universal, as in the first *Physics*, text 4, where it says that one should begin with more universals because they are more known. For physics treats first of the principles involved in coming to be, then of the causes and properties of natural things. In the treatment of the principles involved in coming to be it starts from more universals, because it does not first treat of the particular principles of human generation, etc., but explains the general and most common principles of the coming to be of all things generable, and because in explaining questions of common principles and properties it states the more common first, for example, whether the principles are finite or infiite, contraries or not, and so on.

In outlining the order of proof Menu notes at the outset that three kinds of things are studied in natural philosophy. Some are most known, like motion, and they require no proof. Others are partly known and partly unknown, like the definition of nature, and these need some declaration or proof. Finally there are things that are unknown, and these are either unknown to us and known to nature or they are unknown to nature and known to us. If they are of the first type they require demonstration *a posteriori* or, in Toletus' terminology, "of the effect," and if they are of the second type they require demonstration *propter quid* or, in Toletus' terms, "of the cause." It rarely happens in physics that things are

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object of natural philosophy; 3. On the principles, causes, and properties of the subject in general; 4. On the parts of natural philosophy, along with the order and method to be followed in these books; and 5. On the utility and necessity of the *Physics* and some of its uses in the whole of philosophy.

unknown to us and unknown to nature, and thus it will be most rare to find in natural philosophy the kind of demonstration Averroes refers to as *potissima*, Toletus' "in an unqualified way." In Menu's own words:

> The way of doctrine or the genus of proving is manifold. For there are three kinds of things. Some are most known, and so they do not need proof—for example, motion. Others are partly known and partly unknown, and these need either some declaration or proof, as the definition of nature. Others are unknown or occult and these are either unknown to us and known to nature—and these are demonstrated by demonstration *quia* and *a posteriori* through composites and accidents, as Aristotle indicates in the first book of the *Physics*, texts 2 and 3, or they are unknown to nature and known to us, and these are demonstrated by demonstration *propter quid*. For it rarely happens in physics that things are both unknown to nature and unknown to us, and therefore most rarely will one find the demonstration Averroes calls *potissima*, namely, that which shows the *propter quid* and the *esse* of the thing itself.

We may conclude from the way in which Menu describes the demonstration involved in physics that, though the terminology may be slightly different, his teaching is basically the same as Toletus'. Demonstration "of the cause" is precisely the type of demonstration that involves one in the *regressus*. Thus for Menu as for Toletus there is a close methodological link between teachings of the *Physics* and those of the *Analytics*.

Vitelleschi

The next Collegio professor we shall consider, Mutius Vitelleschi, left both a physics course and a logic course, and his introduction to the *Physics* is much lengthier than either Toletus' or Menu's.[24] Vitelleschi further divides the first chapter of the first book into the five traditional texts found in Joannes Argyropylus' edition of the *Physica Auscultatio* that were made available to our seminar, and comments on these individually. Since in his commentary he addresses logical questions along with physical questions, and toward the end specifically addresses the problem of the "more known" as this is presented differently in the *Physics* and the *Posterior Analytics*, I shall make his analysis available in considerable detail.

Vitelleschi begins by noting that, since it is the common opinion of commentators that Aristotle's project for this book is to investigate and explain the principles of natural things, in these first five texts he discourses on principles and then prefaces a prologue to the whole of natural philosophy. That this matter may be more easily understood, he goes on, we should note that for anything to be put in a science two things must be attended to: first, the order to be followed in treating its subject matter, for example, that in physics we should treat elements before compounds, and second, the instruments that lead us to knowledge of these subjects, for example, demonstration *a priori*, which is the principal instrument, and demonstration *a posteriori*, which is less principal and secondary. In this prologue, therefore, Aristotle proposes three things: first, his intent in the whole of natural philosophy, which is to treat the science and knowledge of natural things, and also in this first book of the *Physics*, which is to treat the knowledge of principles; second, the instruments to be used, which are demonstrations *a priori* and *a posteriori*; third, the order to be followed in the explanations that follow. These matters are taken up in the first three texts of Vitelleschi's commentary, as follows:

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[24] Mutius Vitelleschi, *Lectiones Reverendi Patris Mutii Vitelleschi in octo libros Physicorum et quatuor De caelo*, Romae, annis 1589 et 1590 in Collegio Romano Societatis Iesu, Bamberg, Staatsbibliothek, Msc. Class. 70.

> First text: *Cum circa omnes doctrinas.*[25] In this first text there is a kind of syllogism, though Aristotle gives only the major premise. The syllogism is this: In every method or science containing principles or causes or elements, we must know these to know everything contained within the science. For we think we know a thing when we know its first causes, etc. Therefore the knowledge of natural things is had from the knowledge of principles. Aristotle deduces from this that natural science should begin with a knowledge of matters that pertain to its principles. From these statements we can gather Aristotle's intention for the whole of the *Physics*, which is to treat a science of natural things, and for the first book, which is to explain their principles. Also apparent is the most potent instrument to be used in treating a science of natural things, for this is demonstration *a priori*, which proceeds from causes and principles.
> Second text: *Haec autem insita natura.* Since Aristotle has said that we must treat of principles, a person might object that principles are unknown and thus we cannot obtain the beginnings of this treatise from them. To this I say that Aristotle has now moved back to a less principal instrument, demonstration *a posteriori*, and this is what he is speaking of in this text and the next, for it must be used in the investigation of principles. Thus Aristotle solves the objection: there is inborn in us by nature a way of proceeding from things more known to us to those more known by nature, if the latter are less known to us. What is known to us is not always the same as what is known *simpliciter*. So to investigate the unknown principles of natural things we use demonstration *a posteriori*, which proceeds from what is more known to us.

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[25] The lemmata here are not those given in Vitelleschi's manuscript but those in the text of Ioannes Argyropylus's translation, which was made available to participants in our seminar.

> Third text: *At confusa primo nota nobis.* Aristotle had said that we should proceed from what is more known to us to what is more known to nature. Now he explains what things are more known, and says that "confused things are first known to us," that is, composites, and in these we first know the more universal notes, and then, when we break them down into the parts and principles of which they are composed, the principles themselves come to be known to us. Thus in this text and the preceding we find the following syllogism: For knowing unknown principles we must make use of what is more known to us; but confused and composites are more known to us; therefore we must use them [fols. 32r-33v].

Having used the expression "more known" and indicating that there is a difference between things more known to us and those more known to nature, Vitelleschi now proceeds to a fuller explanation of the distinction. He does this in texts 4 and 5, which focus on Aristotle's use of the term universal and the precise way in which universals are said to be more known. His comments on these texts read as follows:

> Fourth text: *Iccirco ex universalibus.* Here Aristotle proposes the order of doctrine to be followed and the way matters are to be explained following that order. So he says: We should proceed from things more known to us to those more known to nature, which the order of doctrine also demands, but the universal, since it is a kind of whole (*totum est quoddam*), is more known to us than are singulars; therefore the order of knowing demands that we proceed from universals to singulars, that is, to less universals, which can be said to be singulars when compared to more universals. For sciences do not descend to singulars, that is, to individuals.
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> Proof of the minor, namely, that the more universal is more known to us than the less universal: Aristotle gathers this first from text 3. For since universals contain their inferiors confusedly as parts, insofar as we first grasp everything in the thing confusedly, whereas we grasp singulars distinctly, it follows that universals are more known to us. And so we must take our start from them.
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> Aristotle proves the same minor in this text and text 5 with three arguments. First: a whole according to sense or, what is the same, a sensible and quantitative whole, what we call an integral whole, is more known to us than its single parts; but the universal is a type of whole, although not one in the proper sense; therefore, just as when the eye sees a line it grasps all of the parts at once but confusedly and indistinctly, and then the single parts distinctly, so the intellect, having seen a composite individual, first grasps in it the more common notes and then gradually distinguishes those that are less universal.
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> The second argument is given in the words with which he begins text five: *quoddam modo sese habent*, that is, in the same way that names are related to definitions. For a name indicates what appears to be a kind of whole indistinctly and confusedly and signifies an entire thing, such as the word circle; the definition, on the other hand, signifies the same thing clearly and distinctly, signifying its parts; but the name, because it designates a confused whole, is more known to us than the definition; thus the more confused universal is more known than its parts.

> The third argument: children, under nature's leadership, first call all men father with a kind of confused knowledge, and then they gradually distinguish their fathers from other men. They do so because they first note those things that are common to their father and to other men, and then they gradually identify those that are proper to their father; therefore more universals are more known to us [fols. 33v-34r].

Up to this point I have been following Vitelleschi's exegesis of Aristotle's text. Here, however, he breaks off from the exegesis to explain how the text he has been explaining is not opposed to related texts in the *Posterior Analytics*. One might think that the two teachings are radically different, for in the *Physics* Aristotle states that universals are more known to us, whereas in the *Posterior Analytics* he says the opposite, that they are least known to us. Vitelleschi attempts to resolve the difficulty in the following terms:

> From this it is apparent that this text is not in opposition to what Aristotle teaches in the first book of the *Posterior Analytics*, text 12, as he there also notes, but where he says that the most universals are least known to us whereas singulars are more known to us. For it cannot be denied that the singular is always the first known. Since our intellect takes the origin of its knowledge from the senses, and the senses perceive only singulars, the intellect knows them first. Indeed, the intellect conceives singulars first in general fashion, apprehending the notes that are common in it, for example, that it subsists by itself, that it is material, that it moves, etc. Then it gradually grasps its other notes, somewhat like parts, dividing them one from the other clearly and distinctly. From this it follows that we can say that universals are in some way the first thing known by the intellect. Not indeed in the sense that universals can be known without singulars being known, but because, after singulars are so grasped by the senses, the intellect is brought by a kind of general knowledge to the notes that are more universal and common in them.
>
> Briefly, then, to the text of the first book of the *Posterior Analytics* we say that Aristotle is speaking there of the universal *in causando*, as are principles with respect to the conclusion, which he is there treating; for these, since they contain a cause, are more unknown to us than is the conclusion, which states the effect. Here, however, he is speaking of universals *in praedicando*, and the more universal these are, the more known they are to us. The reason is that the accidents we first note in singulars present the more universal notes to us first, not the least universal, as is apparent from experience and is seen in the example of children. For accidents of a more universal type are discerned more generally than accidents of a less universal type. For this reason the mind is more accustomed to them. On this account such universals can also be said to be closer to the senses, because the accidents that they represent are perceived by the senses more often, and thus more readily and more easily. Add that Aristotle is speaking only of a type of general knowledge, for doubtless it is by this knowledge that universals are more known [fol. 34r-v].

Objections can be raised against this reply, however, and Vitelleschi is aware of them. So he proceeds to elucidate it in two alternative ways, after which he recapitulates what he regards as the main point Aristotle is making in his prologue to the *Physics*:

> But you might object: Aristotle says that we should treat first of principles; but principles, since they are principles *in causando*, are less known to us; therefore it is not true that Aristotle begins with what is more known to us. I reply, first: Aristotle is reasoning in the following way. Whenever we are to begin with principles, since other things cannot be known without them, we first adumbrate confusedly and somewhat grossly the notes that are more universal in these principles and so are more known to us, as, for example, that they are more than one, that they are contraries, that they are not accidents, and so on. Then we distinguish those that are less common and more proper, an order that Aristotle himself follows in an exemplary way in this treatise.
>
> Second, we can offer a different response as follows. The ordering of the parts of a science is best taken from their subjects. Thus, when Aristotle says that we are to proceed from more universals, he is not speaking of the principles themselves but of the subjects that are more universal *in praedicando*, in such a way that he wishes first to treat of the natural body in general and then of its individual species, and again of compounds in general and then of their species. This, therefore, is what Aristotle is teaching: in the *Physics* we should explain both the principles of natural bodies and the natural body itself and its species. In treating these matters we should proceed from what is more known to us to what is less known. In treating principles we investigate principles themselves in composites and *a posteriori*, and when we have found them and see the natural body as constituted of them, in treating it we first explain the properties of the natural body in general, and then we pursue its individual kinds. Aristotle treats the first of these up to text 3, the second he prepares for in text 4. Other matters that are customarily explained here we have already treated in our commentary on the *Posterior Analytics* [fols. 34v-35r].

Thus far Vitelleschi. Note how, in the passage just cited, he stresses that we must first investigate principles *a posteriori*, and then, when we have found them, we should use them to explain the properties, that is, demonstrate the properties *a priori*, which is just another way of describing the demonstrative *regressus*. Also his many references to demonstration and its types in this prologue to the *Physics* is a clear indication that he is thinking as a logician, a point reinforced by his reference to his commentary on the *Posterior Analytics* at the very end of his exposition. With regard to this reference, what Vitelleschi apparently has in mind is his discussion of Aristotle's division of the "more known" into more known by nature and more known to us when commenting on texts 11 and 12 of the *Posterior Analytics*.[26] His commentary on this work is rather truncated, and thus, in the copy of his lecture notes that is extant, there is no explicit treatment of the *regressus*, as there is in the commentaries of Toletus, Vallius, and Rugerius.

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[26] Mutius Vitelleschi, *Explicationes in Aristotelis Logicam lectae anno 1588 in Collegio Romano per Professorem Mutium Vitelleschum Societatis Iesu, hodie*

Rugerius

Vitelleschi followed Vallius in teaching the course on the *Physics*, and immediately after him, our next Jesuit, Ludovicus Rugerius, taught the same course. All three had taught the logic course in the year preceding their teaching natural philosophy, so obviously these matters were fresh in their minds. Of all the lecture notes that have survived, those of Rugerius are the most detailed and meticulous, so we should not be surprised that he addresses the problem in which we are interested more directly than the others. He does so in the second question of his exposition of the first book of the *Physics*, which he formulates as follows: "What kind of *progressus* is involved in knowledge with respect to us and in knowledge with respect to nature, in all discourse but particularly in the *Physics*?"[27] Since *progressus* is a generic term that sometimes is used for the *regressus*, the question itself is a promising indication that Rugerius, like Vitelleschi, will combine logical and physical concerns in his exposition of Aristotle's prologue to the *Physics*.

Rugerius' custom is to divide his questions into a number of subquestions or *quaesita*. The *quaesita* for this question he now enumerates as follows: (1) What does it mean to be more known to us and more known to nature; (2) Can the same thing be more known to us and more known to nature; (3) What kind of universal is Aristotle discussing in this place; (4) Is it true that what is more universal is more known to us; (5) Why is it said to be natural for us to proceed from what is more known to us to what is more known to nature; and (6) What is the way of proceeding in these matters in the *Physics*? All of these questions are obviously of great interest, particularly the fifth, where Rugerius explicitly mentions the demonstrative *regressus*. Obviously we cannot treat all of the queries in equal detail. In what follows I shall simply paraphrase the

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Societatis eiusdem Praepositum Generalem, a Torquato Riccio eius discipulo conscriptae, Rome, Biblioteca Apostolica Vaticana, Lat. Borgh. 197.

[27] Ludovicus Rugerius, *Commentariorum et quaestionum in octo libros Physicorum tomus, traditus in Collegio Romano anno Domini 1590*, Bamberg, Staatsbibliotek, Msc. Class. 62-3.

more important elements in each of Rugerius' replies, starting with the first two *quaesita*, which deal with the concept of the "more known":

> *More known to us / more known to nature.* One of the more difficult problems in understanding Aristotle's prologue to the *Physics* is what he means by the distinction "more known to us" vs. "more known to nature." Here Averroes makes the point that elements are more known to nature than are composites, and they are less known to us because we do not make composites the way nature makes them. Therefore, just as with artifacts the artificer knows the things from which artifacts are composed before the composites themselves, so also nature seems to known the things from which natural things are composed, namely, elements, before composites, just as we ourselves would if we were to make them. Some commentators find fault with Averroes for this because he seems to endow nature with intelligence, but actually it is an ingenious and appropriate metaphor. What it intends is not that nature *is* intelligent, but that nature would have this type of knowledge if it *were* intelligent. Thus the definitions to be preferred are the following: "more known to nature" means to be that on which other things depend for their being or coming to be, thus implying the notions of priority and dependency, whereas "more known to us" means whatever is sensed or comes closer to our senses.
>
> *Can the same thing be more known in both ways.* The next query is whether the same thing can be more known to us and to nature. From the foregoing definitions this would appear to be possible if something could be found that is closer to sense and at the same time is that on which another depends in being or becoming. According to Averroes there are no such things in the order of nature, or at least very few, and Aristotle seems quite clear on this. The opposite opinion is that of Pererius, who disagrees with Averroes here and gives examples of such entities that he takes from his own theory of knowledge. Pererius is misguided in this. In physics the same thing can never be more known to nature and to us; rather the contrary is true, for what is more known to nature is always less known to us, and vice versa. The proof: knowledge for us always begins with singulars and composites whereas that for nature works in the opposite direction [fols. 32-39].

The Pererius who is mentioned here is one of Rugerius' fellow Jesuits, Benedictus Pererius, who had taught philosophy at the Collegio Romano from 1561 to 1566, before moving to theology in 1567. Pererius' reading of Aristotle here was apparently influenced by Pererius' idiosyncratic view of universals, with which Rugerius disagrees. He explains the matter more fully in his replies to the third and fourth *quaesita*:

> *More universal / more known to us.* More universal, in this context, means the more universal note in any individual sensed by us. The reason why the more universal is better known than the less universal is not because it is diffused and dispersed among more individuals, as Pererius argues, but because it is more material, for all knowing with respect to us presupposes the materiality of things. Hence it is that from any sensible accident we always start with a material note and go on from that to grasp the less material. And the reason

> why material notes are more known to us is because they have more affinity to us, since we ourselves are more material and corporeal.
>
> *More universal notes in singulars.* Here the text that is of most interest is text 5 of the first book of the *Posterior Analytics.* According to St. Thomas Aquinas, when Aristotle says there that universals are least known to us whereas singulars are more known, he is comparing universals, that is, natures abstracted from particulars, with particulars and singulars, and in this sense what Aristotle says is true. But when we say that universals are more known to us, we mean something else, namely, that there are more universal notes in one and the same material individual and that these more universal notes are what we first grasp in it. Yet Aristotle is right in maintaining that the more universal is the more unknown, because it is more abstracted from the senses and farther away from singularity. So, even though in any singular it is easier to know a more universal note, when we take our minds away from singulars it is more difficult to grasp universals, and particularly genera rather than species, because as so abstracted they are more distant from the individual [fols. 39-44].

This brings us to Rugerius' fifth query, where he investigates what it means to say that it is "more natural" to proceed from what is more known to us to what is more known by nature. Here everything depends on the precise meaning one attaches to the term nature. Rugerius distinguishes five different meanings of this term, the first three of which he characterizes as follows:

> *What is more natural for us.* The fifth query inquires why it is said to be natural to proceed from the more known to us to the more known to nature, and not vice versa. One may answer this by distinguishing five different senses of the word natural and showing how, in four of the five meanings, the procedure advocated by Aristotle cannot be said to be natural. In Aristotle's fifth meaning it can, and this then forms the basis for an affirmative answer.
>
> The *first* meaning of a natural way of proceeding is similar to the mode nature takes in producing things, as explained in the first query, and since this is the opposite of the way we understand things, in this sense our mode of knowing is not natural. A *second* meaning of natural is what is congruent with or agreeable to the nature of things, and this mode would require, for example, that knowledge of an accident be dependent on knowledge of substance, whereas here too we proceed in the contrary direction, from knowledge of accidents to knowledge of substance.
>
> In a *third* meaning natural is said to be what every nature seeks, and even in this way this process is not said to be natural, for man desires by nature to know scientifically, and to know scientifically is to know a thing through its cause. Hence, because the more known to nature are the causes of the things that are more known to us, our intellect does not arrive at this knowledge except through the demonstrative *regressus.* Using the regress, through knowledge in relation to us we arrive at knowledge of causes, and then by going back from them we come to knowledge of effects, and it is this latter knowledge that is knowledge according to nature.

Note here, in explaining the third meaning, that Rugerius makes reference to the demonstrative *regressus* and notes how it is a natural way of proceeding for those who desire to know scientifically. Although he does not say so here, he has a thorough treatment of the *regressus* in his questions on the *Posterior Analytics*,[28] so there can be no doubt as to how he understood the term.

The remaining two meanings of the term natural Rugerius then explains as follows, concluding with a brief note on connatural ways of gathering knowledge that normally precede scientific understanding:

> The *fourth* meaning of natural is anything that is so proper to the nature of man that he cannot be diverted or torn from it. Even in this sense the process is not said to be natural, for though unlearned and ignorant men proceed in this way in their knowledge, those who are expert and learned in the scientific and demonstrative mode of knowing proceed from things more known to nature to those more known to us, and thus it is not contrary to man's nature to do so.
>
> That leaves only the *fifth* meaning, and this is the one that permits an affirmative response. The process of which Aristotle speaks is natural in this sense, that natural means what is done only under "nature's leadership"[29] and without the guidance of any discipline, for this is the process we use when led by nature *before* we have been instructed in various disciplines. This happens in the following way. When we are stimulated from the admiration of effects to investigate the natures of things, and are led by nature in our examination of singulars, we are able to form concepts at the lowest level of universality by comparing things and noting similarities; from such concepts we ascend to the more universal, and so on until we arrive at the most universal. Again, from diligent inspection of composites we discern their parts and the parts of the parts until we come to the ultimate elements. Finally, again under nature's leadership, when we perceive a singular thing we conceive its most universal notes, and then we descend to the less universal. This is apparent in the things we know best, for we first know it to be a being, then a body, then an animal, and then a man, and in children who know their own fathers they first know them as men rather than as particular men, and so they call all men father. And in knowing all these things we proceed in a direction opposite from the way we do in science. For in science, omitting such knowledge of singulars, with which science is not concerned, we proceed from the most universal to the least so as to arrive at the lowest species; again, we proceed from the most basic simples to the things that are composed of them.
>
> And yet, many sayings of Aristotle attest that there is a connatural way of gathering knowledge *prior to* attaining science. For example: When a sense is lacking there can be no science of matters that pertain to that sense. Again: All sciences and arts take their origin from the senses and from memories and

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[28] Ludovicus Rugerius, *Commentariorum et quaestionum in Aristotelis Logicam tomus traditus in Collegio Romano anno Domini 1589*, Bamberg, Staatsbibliothek, Msc. Class. 62-1 and 62-2.

[29] This is Vitelleschi's expression; see above, 241.

> experiences. Yet again: Our intellects never think of anything without adverting to phantasms. And yet again: The concepts on which intellection is based are not phantasms, but without phantasms they would not exist. All of these statements attest to a connatural mode of knowing that provides the basis for science, even though it is not scientific knowing itself.

With these prenotes explained, Rugerius comes to his final query in this question, whether in physics we *do* proceed from the more known to us to the more known to nature.[30] His answer is somewhat surprising, but of key importance for this seminar. In general, he says, we do not: the universal mode of proceeding in physics is the scientific mode, from the more known to nature to what is more known to us. But sometimes, in certain parts of the discipline, occasionally, for greater facility, we begin with what is more known to us to investigate what is more known to nature. The example he gives from the *Physics* is in the eighth book, moving from motion, which is more known to us, to investigate the First Mover, which is more known to nature. (It is noteworthy that Zabarella gives an example from the first book, moving from motion to *materia prima*, which is also more known to nature.) Rugerius cites also the second book of *De anima*, where Aristotle treats sight before touch, though touch is prior by nature to sight and extends to more objects. So the surprising result of Rugerius' analysis (and it is congruent with views expressed in the other notes I have analyzed) is that regressive methodology, which begins with what is more known to us, is not the universal method followed in natural science. It does have very important uses, however, as should be clear from the many illustrations I have given of how Galileo employed it in my *Galileo's Logic of Discovery and Proof.*

Regressive Method in the Study of the Soul

I have just mentioned Rugerius' reference to the second book of *De anima*, but thus far have said nothing of Jesuit teachings on the mode of proceeding in the study of the soul. Apart from the introductory text of the *Physics*, our seminar also focused on the introductory portions of the *De anima* and the *De partibus animalium.* Before concluding, therefore, it might be well that I make a few remarks about regressive methodology and how our Jesuit authors saw Aristotle employing it in the study of living organisms.

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[30] Ludovicus Rugerius, *In octo libros Physicorum* (as note 27), fols. 47-8

As noted in my previous writings, Rugerius' complete course on philosophy is preserved in a series of codices now at the Staatsbibliothek Bamberg; one of these codices contains his commentary and questions on *De anima*. Curious about this, I arranged to spend a few days in Bamberg on my way to the seminar, and while there I copied out his introduction to that work. What follows is a paraphrase of that introduction.[31] Although Rugerius does not mention the *regressus* in the portion I copied, his teaching there is also quite congruent with a regressive methodology.

Rugerius begins by noting the procedure one should follow when analyzing the principles and the properties of living bodies:

> To have perfect knowledge of the proper subject of a science one must have knowledge of the subject's nature or internal principles and also knowledge of its properties. The entire treatise on the living body (*corpus animatum*) will thus have two parts, one dealing with its principles, the other with its properties. But the internal principles are two: one is its proper matter, that is, its parts, both homogeneous and heterogeneous; the other is its form, that is, its soul. The matter or parts are explained in *De partibus animalium*, with those parts relating to movement being additionally treated in *De incessu animalium*. The form is treated in the three books of *De anima*. Then the properties and operations of the living body are covered in the remaining books, the *Parva naturalia* [3-4].

With this as a preamble, Rugerius sketches the ordering of the various biological works in the Aristotelian corpus that should be followed for the implementation of these principles:

> When putting order into the books on living things one should locate the books of *De historia animalium* first. These books are *not* a part of natural science, for they explain the accidents and operations that are known from experience and sense alone, without assigning causes for them. Yet Aristotle proceeds in these historical books in the same way as in the others: in the first four books things that pertain to their matter and parts, in the remaining books things that pertain to their operations and accidents. There is no discussion of the soul in them, since the soul cannot be perceived by the senses.
>
> Immediately following the *De historia animalium* come the books *De partibus animalium*, for with these Aristotle begins his scientific treatment of the living body. He does so by treating the parts of animals demonstratively (*demonstrative*), assigning the final cause of each part, that is, the operation and function for which nature uses it as a proper instrument. But in animals there are three important kinds of parts: some look to the animal's *esse* or *bene esse*, and these are mainly explained in the books *De partibus animalium*; others look to the animal's movement, and these are explained in *De incessu animalium*; and yet

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[31] Ludovicus Rugerius, *Commentariorum et quaestionum in tres libros De anima tomus, traditus in Collegio Romano anno Domini 1592*, Bamberg, Staatsbibliothek, Msc. Class. 62-6. Page numbers are given in square brackets.

> others look to the way the animal generates offspring, and these are explained in the books *De generatione animalium.*
>
> After all these matters have been demonstrated, then one should turn to the study of the animal's form, to the three books of *De anima.* These are concerned with the soul considered in itself, not with its operations except insofar as these may be necessary for understanding the soul's nature. Thus, the books *De anima* focus on the form of the living body considered precisely in its nature and as it is a constitutive principle of the *corpus animatum.* This completes the defining process, as it were, and prepares for the scientific demonstration of the properties and accidents that are proper to living things [4-5].

Having completed this comprehensive outline, Rugerius draws his discussion to a close by remarking on the scientific content of the *De anima* and how this work is intimately related to the other treatises contained in Aristotle's *Parva naturalia.* He writes:

> It turns out that some scientific reasoning is found in the *De anima* itself, but the arguments there are based on imperfect knowledge, that is, on common opinion, and this suggests a fuller treatment elsewhere. The "elsewhere" is in the books of the *Parva naturalia.* The accidents and operations that are considered in these books are of two kinds: some are common to all living things; others are proper to animals. Again, accidents that are proper to animals are of two kinds: some follow on the nature of the genus absolutely taken; others follow on the ultimate nature and differentia of the species. Of the first kind is sense knowledge, of the second, movement [5-6].

Rugerius does not go into detail on how demonstrations are made of either of these operations. Even from this overview, however, it is easy to see how Rugerius recognizes how Aristotle's procedure in the study of the *corpus animatum* parallels the study of the *corpus naturale* in the *Physics.* In each case we start with details that are closer to sense, and then, "under the leadership of nature," come to the universal notes of particular parts, and finally to the most universal notes—in this case those that characterize the soul itself. This is essentially a regressive methodology, although in his exposition Rugerius does not use the term *regressus.* Once we have regressed to first principles in this way, we are prepared to demonstrate the functions and operations that are proper to living things, first in their generic modalities, then in more and more specific detail, until we ultimately descend to the *infima species* of living things in their almost infinite variety.

The answer to Professor Kessler's query with which I began this discussion of regressive method should, then, be clear. Within the context of the Aristotelianism that was taught at the Collegio Romano in the 1580s and 1590s there was a close tie between the logic course and the courses offered in natural philosophy. This is true in general, and it is also true of the special tract on the demonstrative *regressus*. The teaching notes of Toletus, Menu, Vitelleschi, and Rugerius bear this out with regard to their courses on the *Physics*, and Rugerius' introduction to his course on the *De anima* explains in a general way how regressive methods had to be employed not only in that work but also in the *De partibus animalium*. With regard to the *De anima*, Toletus' introduction to that work, which I have not discussed here, coheres well with Rugerius' analysis. From the viewpoint of what is more known by nature Toletus argues that the *De anima* should precede the *De animalibus*, but from the viewpoint of what is more known to us, the *De animalibus* should precede the *De anima*, which is precisely what a regressive methodology would demand.[32]

Sequel

With this I come finally to my sequel. I entitled my interpretative volume on Galileo's logic *Galileo's Logic of Discovery and Proof*. By that title I intended to show that, though the concluding part of the demonstrative regress employs a logic of proof, the more important part is that with which it begins, a logic of discovery. In the *Logica Utens* part of the volume I provided example after example to show how Galileo employed, at least implicitly, his paradigm of the demonstrative *regressus* to make the claims he did for the "new sciences" he was so intent on discovering. To return to the prelude of this essay, I could fit into that same paradigm the method of resolution and composition that was used by Dietrich von Freiberg in the early 1300's to discover the correct optical explanation of the primary rainbow.[33] I could also incorporate into that paradigm, as I did partially in *Galileo's Logic of Discovery and Proof*, the work of Domingo de Soto on motions that are *uniformiter difformis*, which was to lead eventually to Galileo's formulation of the law for free fall in naturally accelerated motion.[34]

If space permitted I could go further and show how the same pattern of thought can be discerned in the great classic of William Harvey, *On the*

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[32] Franciscus Toletus, *Commentaria una cum Quaestionibus in tres libros Aristotelis de Anima*, Cologne 1615, fols. 5ra-6ra.

[33] *Scientific Methodology* (as note 4), 132-248.

[34] "Domingo de Soto and the Iberian Roots of Galileo's Science" (as note 11); see also my "Duhem and Koyré on Domingo de Soto," *Synthese* 83 (1990), 239-60, and *Prelude to Galileo* (as note 9), 192-252 and 303-19.

Motion of the Heart and Blood.[35] Harvey, of course, was a professed Aristotelian who had studied at the University of Padua, where teaching on the *regressus* had reached its fullest state of development. And, even more surprisingly, I could show how Sir Isaac Newton used the same regressive methods, those of resolution and composition, to explain the colors of the prism, the famous *experimentum crucis*, in his letter to the *Philosophical Transactions* of 1672.[36] These are works of scientific discovery where the investigator starts with what is more known to us to come eventually to a knowledge of its cause, to what is more known to nature. I analyzed all of these cases in a work published in 1972, the first volume of my *Causality and Scientific Explanation.*[37] I remember calling this to the attention of Charles Schmitt once, when he was lamenting the lack of appreciation for Aristotle in the present day, and he replied, "Yes, I know that, but no one cites your work."

Perhaps now I have a second chance. As the programme sketched by Professor Kessler and other works in this volume is filled out, fuller accounts of Aristotelian method will surely be found in Renaissance commentaries. But I am not too sanguine about this prospect, for my own studies of Jesuit printed works thus far have turned up very little—it is mainly in manuscript sources that I have had the greatest success. Many of the books in Kessler's bibliography are standard expositions of Aristotelian natural philosophy, which means that they mainly follow the order of doctrine, going from what is more known to nature to what is more known to us. Science textbooks in the present day do the same: they start with the principles of the discipline and proceed from these to explain the generally accepted conclusions. So in textbooks there is little room for novelty, now as in ages past. But the Renaissance may prove to be different, and, of course, we never know what will turn up when we become seriously involved in textual research.

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[35] See my *The Modeling of Nature: Philosophy of Science and Philosophy of Nature in Synthesis,* Washington, D.C., 1996, 350-5, 396-400; also my "Three Classics of Science. The Reviews of Three Great Books: Galileo, *Two New Sciences*; Gilbert, *The Loadstone and Magnetic Bodies*; and Harvey, *The Motion of the Heart and Blood,*" in: *The Great Ideas Today 1974*, Chicago 1974, 211-72.

[36] *Scientific Methodology* (as note 4), 270-8. For Newton's knowledge of Renaissance Aristotelianism, see my "Newton's Early Writings: Beginnings of a New Direction," in: G. V. Coyne et al. (eds.), *Newton and the New Direction in Science*, Vatican City 1988, 23-44, and "Aquinas and Newton on the Causality of Nature and of God: The Medieval and Modern Problematic," in: R. J. Long (ed.), *Philosophy and the God of Abraham*, Toronto 1991, 255-79. See also *The Modeling of Nature* (as previous note), 355-363, 400-409

[37] Cited in note 8 above; see 94-103, 135-9, 184-93, and 194-210.

GALILEO AND THE MIXED SCIENCES*

W. Roy Laird

Galileo is still often portrayed as having overthrown Aristotelian natural philosophy and method in order to found his new science of motion. Rejecting entirely the Aristotelian search through logic for causes and essences, the story goes, Galileo sought to describe the physical world mathematically and from experience. To provide the methodological grounding of his work, historians in the past have attributed to Galileo various philosophical and metaphysical predelictions—instrumentalism, Platonism, Hermeticism, and the like. Until rather recently, however, there has been a certain reluctance to find in Galileo much influence from what was decidedly the predominant school of philosophy and the common background to all intellectual activity in the sixteenth and early seventeenth century: Aristotelianism.

But since John Herman Randall's seminal essay on "The School of Padua and the Emergence of Modern Science," first published in 1940, there has come a steady flow of scholarship on Renaissance Aristotelianism, and it is now possible to see the early-modern philosophical landscape for the first time in proper perspective, with Aristotle looming large in the foreground. The works of Bruno Nardi, Antonino Poppi, Charles H. Lohr, Charles B. Schmitt, and others have opened up a whole vista of Renaissance Aristotelianism to historical scrutiny. We are now in a better position than ever before to trace the origins and to assess the context of Galileo's achievements.[1]

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* I should like to thank William A. Wallace and Luce Giard for their helpful criticisms of an earlier version of this paper.

[1] J. H. Randall, "The Development of Scientific Method in the School of Padua," in: *Journal of the History of Ideas* 1 (1940), 177-206 (without the Latin texts in the notes); repr. in: *The School of Padua and the Emergence of Modern Science* (Saggi e Testi 1), Padua 1961; compare also his "Paduan Aristotelianism Reconsidered," in: E. P. Mahoney (ed.), *Philosophy and Humanism: Renaissance*

In his essay Randall completely reversed the usual role of Aristotelianism in early modern science by arguing that the source of Galileo's scientific method of experimental discovery and rational proof lay in the method of *regressus* of sixteenth-century Aristotelians such as Agostino Nifo and Jacopo Zabarella. Tracing the origins of this method from the thirteenth century through commentaries on Aristotle's natural works and on medical writings, Randall found that it was Paduan commentators from Pietro d'Abano onwards who turned Aristotle's didactic method of resolution and composition into a true method of discovery and proof, the double method of *regressus*.

But what was missing in Randall's thesis was a historical connection between the school of Padua and Galileo. Did Galileo get the double method (assuming that he used it) from the works of Zabarella and others, or did he hit upon it independently, as he did the mean-speed theorem and other rules well known in the fourteenth-century calculatory tradition? A connection lay perhaps in Galileo's unpublished writings on foreknowledge and demonstration, but these Antonio Favaro did not print in his definitive edition of Galileo's works, judging them to be juvenilia, mere scholastic exercises of an adolescent Galileo and products of his hand but not of his head. Even Randall dismissed their importance for Galileo's later science.[2] But in the late 1960s A. C. Crombie and Adriano Carugo discovered Galileo's sources for these early writings, not in the works of Paduan Aristotelians, but in the published commentaries on Aristotle's *Posterior Analytics* of Jesuits teaching at the Collegio Romano, the Jesuit College in Rome, including those of Francisco Toledo, Benito Pereira, and Ludovico Carbone.[3] William A. Wallace has since gone

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Essays in Honor of Paul Oskar Kristeller, Leiden 1976, 275-82. The literature on Renaissance Aristotelianism is now extensive: see for instance: Bruno Nardi, *Saggi sull'aristotelismo padovano dal secolo XIV al XVI*, Florence 1958; Antonino Poppi, *Introduzione all'aristotelismo padovano* (Saggi e Testi 10), Padua 1970; C. B. Schmitt, *A Critical Survey and Bibliography of Studies on Renaissance Aristotelianism, 1958-1969*, Padua 1971; idem, "Towards a Reassessment of Renaissance Aristotelianism," in: *History of Science* 11 (1973), 159-193; idem, *Aristotle and the Renaissance*, Cambridge, MA 1983; C. H. Lohr, *Latin Aristotle Commentaries II: Renaissance Authors*, Florence 1988.

[2] A. Favaro, *Rendiconti della R. Accademia dei Lincei* (Classe di scienze morale, storiche, et filosofiche, Serie V, 27), 1918, 139-150; J. H. Randall, *Career of Philosophy*, New York 1962, vol. 1, 282.

[3] A. C. Crombie, "Sources of Galileo's Early Natural Philosophy," in: M. L. Righini Bonelli and W. R. Shea (eds.), *Reason, Experiment, and Mysticism in the*

much further to find Galileo's immediate sources in unpublished notes for lectures given by Paulus Valla (or Vallius), which were plagiarized by Carbone, and the lectures of other Jesuit professors at the Collegio Romano. In addition, Wallace has argued that the method actually used by Galileo in his mature scientific works was precisely the regressive method perfected by Zabarella that Galileo had found in these Jesuit lectures. The problem of Galileo's method has been solved.[4]

One of the products of this scholarship is the first printed edition of the early writings on foreknowledge and demonstration, edited by William F. Edwards and William A. Wallace, and a translation and commentary by William A. Wallace.[5] It is now convenient for the first time to examine these writings for their treatment of particular topics, compare them to Galileo's sources and contemporaries, and assess the extent of their influence on Galileo's scientific work. One such topic—my particular interest and the subject of this paper—is the problem of the so-called mixed sciences, the mathematical sciences such as astronomy, optics, harmonics, and mechanics.

The mixed sciences are pertinent because Galileo's science of motion would seem to have been a new such science. This has long been recognized by Thomist historians of medieval natural philosophy,[6] but

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Scientific Revolution, New York 1975, 157-75, 303-5; A. Carugo and A. C. Crombie, "The Jesuits and Galileo's Ideas of Science and of Nature," in: *Annali dell' Istituto e Museo di Storia della Scienza di Firenze* 8 (1983), fasc. 2, 3-68.

[4] W. A. Wallace, "Galileo and the Thomists," in: *St. Thomas Aquinas 1274-1974 Commemorative Studies*, Toronto 1974, vol. 2, 293-330; idem, "Galileo and the *Doctores Parisienses*," in: R. E. Butts and J. C. Pitt (eds.), *New Perspectives on Galileo*, (University of Western Ontario Series in Philosophy of Science 14), Dordrecht/Boston/London 1978, 87-138; idem, *Prelude to Galileo: Essays on Medieval and Sixteenth-Century Sources of Galileo's Thought*, Dordrecht/Boston/London 1981; idem, *Galileo and His Sources: The Heritage of the Collegio Romano in Galileo's Science*, Princeton 1984); and *Galileo's Logic of Discovery and Proof*, Dordrecht/Boston/London 1992.

[5] Galileo Galilei, *Tractatio de praecognitionibus et praecognitis and Tractatio de demonstratione*, ed. W. F. Edwards and W. A. Wallace (Saggi e Testi 22), Padua 1988; W. A. Wallace, *Galileo's Logical Treatises* (Boston Studies in the Philosophy of Science 138), Dordrecht/Boston/London 1992.

[6] For example, see J. A. Weisheipl, "The Evolution of Scientific Method," in: V. E. Smith (ed.), *The Logic of Science*, New York, 1964, 59-86; and idem "The Relationship of Medieval Natural Philosophy to Modern Science: The Contribution of Thomas Aquinas to its Understanding," in: *Manuscripta* 20 (1976), 181-96; both these essays are reprinted in idem, *Nature and Motion in the*

only recently adverted to by others, notably Peter Machamer and James G. Lennox. According to Machamer, Galileo was led to consider motion mathematically and create a new mixed science in part because of the sixteenth-century revival of neo-Platonism and the mathematical realism it was supposed to have encouraged. Machamer argued further that Galileo appealed to material, formal, and final causes in demonstrations within his science and thus obviated the criticisms of Aristotelian philosophers that such sciences can demonstrate only through formal causes.[7] More recently, James G. Lennox has examined Aristotle's method for the mixed sciences and concluded that for Aristotle their demonstrations are properly scientific and that Galileo's science of motion meets Aristotle's requirements for a mixed science.[8]

If Galileo's new science of motion corresponds to an Aristotelian mixed science, then to what extent was Galileo actually in the debt of the Aristotelian methodological tradition of the mixed sciences? In what follows, I should like to sketch this tradition, point out its main concerns and conclusions, and show generally how discouraging it would have appeared to one setting out to found a new, demonstrative mixed science, especially in the form it came to Galileo in. An examination of Galileo's early compilations from Jesuit sources on foreknowledge and demonstration will show the limited extent of Galileo's explicit reference to this tradition. Finally, I should like to show that Galileo seemed little troubled with the sort of problems that exercised the Aristotelian commentators, and that even in his earliest works on motion he was faced with a different sort of methodological problem, one that did not arise within the Aristotelian methodological tradition of the mixed sciences. But first let me describe very briefly this tradition.

The methodological tradition of the mixed sciences found its orgins in a few scattered remarks by Aristotle, the most significant of which are in the *Posterior Analytics*, the others in the *Physics* and the *Metaphysics*. In brief, mathematical sciences such as astronomy and optics were

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Middle Ages (Studies in Philosophy and the History of Philosophy 11), Washington 1985.

[7] P. Machamer, "Galileo and the Causes," in: *New Perspectives on Galileo* (as note 4), 161-180.

[8] J. G. Lennox, "Aristotle, Galileo, and 'Mixed Sciences'," in: W. A. Wallace (ed.), *Reinterpreting Galileo* (Studies in Philosophy and the History of Philosophy 15), Washington 1986, 29-51.

discussed by Aristotle as exceptions to the general rule that scientific demonstrations must be from proper principles and cannot pass from one subject genus to another. Astronomy and optics and the like apparently violate this rule because in them one can use mathematical principles and demonstrations to arrive at conclusions about physical things (such as planets and visual rays). This Aristotle allowed because such sciences are related to pure mathematics (geometry and arithmetic) as one under the other (θάτερον ὕπο θάτερον, *altera sub altera,* hence *subalternate*). But in the lower science, Aristotle continues, one knows the fact (ὅτι, *quia*), while in the higher one knows the reason why (διότι, *propter quid*). Further, in characterizing how such sciences differ from natural philosophy (φυσική, *physica*) on the one hand and from pure mathematics on the other, Aristotle in the *Physics* called astronomy, optics, and harmonics the "more physical of the mathematical sciences" (τὰ φυσικώτερα τῶν μαθημάτων), noting that although mathematical things such as lines are treated in them they are treated not as mathematical but as physical. Unfortunately, Aristotle seems to contradict this in the *Metaphysics*, where he writes that optics and harmonics consider visual rays and sounds, but only as lines and numbers.[9] From these scanty hints the medieval and later commentators worked out their theories of the demonstrative status of the mixed sciences.

Commentators on the *Posterior Analytics*, from Robert Grosseteste onwards, tended in general to emphasize the physical rather than the mathematical aspect of the mixed, or, in Grosseteste's term, the subalternate sciences. They argued that, despite the usefulness of mathematical proofs in the subalternate sciences, such proofs demonstrated only quantitative accidents of the physical subject, and then only through their formal causes, not their material, efficient, or final causes.[10] For

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[9] Aristotle, *Posterior Analytics*, I. 7, 75a38-b17; I. 9, 76a4-25; and I. 13, 78a22-79a16; *Physica*, II. 2, 193b22-194a12; and *Metaphysica*, M. 3, 1078a9-21; see M. F. Reidy, "Aristotle's Doctrines Concerning Applied Mathematics," PhD thesis, Univ. Toronto 1968; and R. D. McKirahan, Jr., "Aristotle's Subordinate Sciences," in: *British Journal for the History of Science* 11 (1978), 197-220.

[10] W. R. Laird, "The *Scientiae Mediae* in Medieval Commentaries on Aristotle's *Posterior Analytics*," PhD thesis, Univ. Toronto 1983; for a discussion of *Physics* commentaries on this subject, see J. Gagné, "Du *quadrivium* aux *scientiae mediae*," in: *Arts libéraux et philosophie au moyen âge: Actes du quatrième congrès internationale de philosophie médiévale*, Montreal 1969, 975-86; on the wider problem of the passing of demonstrations from one science to another, or *metabasis*, see S. J. Livesey, "*Metabasis*: The Interrelationship of the Sciences in

Grosseteste—as for most later commentators, who either explicitly or implicitly followed his interpretation—this meant that while a geometrical proposition may be *propter quid* when it concerns lines in the abstract, when it is applied to physical things such as visual lines, it is only *quia*, for the conclusion in optics is proved by the geometer only in its universal (*in suo universali*). To prove the law of reflection, for example, first the geometer proves that the abstract angles of certain abstract triangles are equal. Then the optical scientist takes this purely geometrical proof and adds to each term the physical condition "visual", thereby restricting or limiting the proof to visual lines or rays of sight. But for Grosseteste the addition of the physical condition alters the demonstrative status of the original proof, changing it from *propter quid* to *quia*. Geometry can prove that the visual angles are equal, but not why they are. This is because the proximate cause of the equality of the visual angles is not in geometry at all, but in the physical nature of light, which only the natural philosopher can know.[11] Some commentators, such as Albertus Magnus, Aegidius Romanus, and Paul of Venice, expressed this limitation of mathematics by suggesting that the subalternate sciences were under not only pure mathematics but also natural philosophy: while through pure mathematics one can prove *quia* the mathematical properties of the physical subjects, only in physics can one prove them *propter quid*. For Thomas Aquinas, in contrast, who coined the term "middle sciences" (*scientiae mediae*), the subjects of higher and lower sciences are related not as genus to species or universal to particular, but as form to matter, so that the middle sciences are formally mathematical; consequently only mathematical demonstrations can be *propter quid* in them. Such demonstrations, however, are available only to the pure mathematician and are limited to the formal cause, while the practitioner of the lower science is restricted to

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Antiquity and the Middle Ages," PhD thesis, Univ. California at Los Angeles 1982; idem, "William of Ockham, the Subalternate Sciences, and Aristotle's Theory of *metabasis*," in: *British Journal for the History of Science* 18 (1985), 127-45; idem, "The Oxford *Calculatores*, Quantification of Qualities, and Aristotle's Prohibition of *metabasis*," in: *Vivarium* 24 (1986), 50-69; and idem, *Theology and Science in the Fourteenth Century: Three Questions on the Unity and Subalternation of the Sciences from John of Reading's Commentary on the Sentences* (Studien und Texte zur Geistesgeschichte des Mittelalters 25), Leiden 1989.

[11] See W. R. Laird, "Robert Grosseteste on the Intermediate Sciences," in: *Traditio* 43 (1987), 147-169.

quia demonstrations and sensible experiences.[12] Later commentators, including Aegidius Romanus, Walter Burley, and Paul of Venice, were similarly excercised mainly by the relation between the subjects of the lower and higher sciences, and adapted terminology from Averroes to distinguish the thing considered by a science (*res considerata*) from the way of considering it (*modus considerandi*). For them, the subalternate sciences differed from both physics and pure mathematics by considering the same thing but in a different way (that is, as physical).[13] Finally, the sixteenth-century Paduan commentator Jacopo Zabarella turned this conclusion on its head, arguing that the mixed sciences differ in no way from pure mathematics in how they consider their subject (in *modus considerandi*), for both consider their subjects mathematically. Rather, they differ in what they consider (in *res considerata*), in that the lower adds a sensible quality to the subject of the higher. By virtue of this sensible quality one can acquire knowledge *quia* through the senses in the lower science, which is how Zabarella understood Aristotle's attributing knowledge *quia* to them. Zabarella thus concluded that the mixed sciences are formally and essentially mathematical and that in them only mathematical demonstrations can be *propter quid*, but, unlike pure mathematics, they can also avail themselves of sensible knowledge.[14] How such sensible knowledge is to be acquired, and how it is to be used within the mixed sciences, Zabarella did not elaborate.

In sum, the whole concern of the Aristotelian commentators was over the relation between the subjects of higher and lower sciences, over what demonstrative force a pure mathematical demonstration retained when "conditioned by," or "applied" or "restricted" to a physical subject, and over what Aristotle meant when he said that in the higher science one knows *propter quid* while in the lower only *quia*. In accordance with their understanding of Aristotle, the commentators all sought to keep the terms of premises and conclusions within the same subject genus. For most of them this meant that a mathematical proof in a mixed science is *quia*, not *propter quid,* since it is not made through the proximate, necessarily physical cause of the composite predicate's adhering in the composite subject. And when a mathematical middle term proved a mathematical predicate of a physical subject, the proof was usually considered *quia* through the remote cause. Only Zabarella and, in a more limited way, Aquinas, allowed for *propter quid* mathematical demonstrations in the mixed sciences. But in all these methodological treatments of the mixed sciences, there is no discussion of how one might acquire the minor premise of such demonstrations, the premise that attributes a mathematical property to a physical subject.

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[12] On Aquinas' view of the middle sciences see Carlos A. Ribeiro do Nascimento, "Le statut épistémologique des 'sciences intermédiaires' selon s. Thomas d'Aquin," in: *Cahiers d'Études Médiévales*, 2 (1974), 33-95; and Laird, "The *Scientiae Mediae*" (as note 10), 94-131, esp. 109-14.

[13] Laird, "The *Scientiae Mediae*" (as note 10), 132-217.

[14] Ibid., 218-53, especially 226-236.

Jesuit commentators associated with the Collegio Romano followed the general tradition of the mixed sciences; despite their citations of Aquinas and Zabarella, however, none of them advanced a position on the mixed sciences that allowed for *propter quid* mathematical demonstrations. On the contrary, they often doubted whether demonstrations within the mixed sciences could even be demonstratively certain, let alone *propter quid.* This was in part a symptom of the widespread doubt over the certainty of mathematics in general expressed by several prominent Jesuit professors at the Collegio Romano.[15] For Francesco Toledo and more emphatically for Benito Pereira, mathematical demonstrations are not Aristotle's paradigm for the most powerful demonstrations, since their demonstrations have as subjects only the accidents of things (quantity) and not substance, and because they do not appeal to causes. Physics, in contrast, although dealing with material things and so being of a lesser nobility than mathematics, proves real properties of real substances through real causes. Despite the uncertainties of dealing with material things, at their best demonstrations in physics answer to Aristotle's ideal of the most powerful demonstrations. As for the mixed or middle sciences, they have all the disadvantages of being mathematical—they do not demonstrate through causes—and all the uncertainty of physics—their subjects involve physical things. But they have the further disadvantage that they must use principles borrowed and adapted from another science. So their demonstrations not only are not *potissimae*, they are not even *propter quid*, and perhaps they are not even certain.[16] For Ludovico Carbone, who plagiarized extensively from the lecture notes of Paulus Valla,[17] the principles of middle sciences are known not *per se* but only through pure mathematics (*per subalternantem*); of themselves, the middle sciences are merely faith or opinion. But even when the optical scientist, for example, demonstrates using geometrical principles, the result is not *propter quid*, for he is not demonstrating concerning the proper subject of those principles.[18] Although Carbone seems to follow Zabarella in characterizing the middle sciences in general as formally mathematical with an accidental condition added to their subject, he disallows demonstration through causes in astronomy, arguing that in astronomy one demonstrates either through appearances without determining whether they are causes or not, or through false premises (such as eccentrics and epicycles) assumed merely to save appearances.[19]

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[15] On the debate over the certainty of mathematics, see G. C. Giacobbe, "Il *Commentarium de certitudine mathematicarum disciplinarum* di Alessandro Piccolomini," in: *Physis* 14 (1972), 162-93; idem, "La riflessione metamatematica di Pietro Catena," in: *Physis* 15 (1973), 178-96; idem, "Epigoni nel Seicento della *Quaestio de certitudine mathematicarum* Giuseppe Biancani," in: *Physis* 18 (1976), 5-40; idem, "Francesco Barozzi e la *Questio di certitudine mathematicarum,*" in: *Physis* 14 (1972), 357-74; idem, "Una gesuita progressista nella 'Questio de certitudine mathematicarum' rinascimentale: Benito Pereyra," in: *Physis* 19 (1977), 51-86; and A. Carugo, "Giuseppe Moletto: Mathematics and the Aristotelian Theory of Science at Padua in the Second Half of the 16th Century," in: L. Olivieri (ed.), *Aristotelismo Veneto e Scienza Moderna*, 2 vols., Padua 1983, vol. 1, 509-17; on the place of mathematics in the educational policy of the Jesuits, see A. C. Crombie, "Mathematics and Platonism in the Sixteenth-Century Italian Universities and in Jesuit Educational Policy," in: Y. Maeyama and W. G. Saltzer (eds), *Prismata: Naturwissenschaftsgeschichte Studien*, Weisbaden 1977, 63-94; G. Cosentino, "L'inseguamento delle matematiche nei collegi Gesuitici nell'Italia settentrionale," in: *Physis* 13 (1971), 205-17; idem, "Le matematiche nella *Ratio Studiorum* della Compagnia di Gesù," in: *Miscellanea storica Ligure* 2/2 (1970), 171-213.

Now, finally, to Galileo. Wallace has shown that Galileo compiled his early works on foreknowledge and demonstration from Jesuit lectures, relying especially on the notes of Paulus Valla, which are now lost but are presumably well represented in Carbone's plagiarism.[20] Yet despite the more extensive discussions in these sources, there are only four brief passages in Galileo's compilations where the mixed sciences (he calls them "subalternated sciences") are mentioned. The first occurs in the *Treatise on Foreknowledge*, where Galileo simply asserts that it pertains to a higher science to prove principles proper to it that are used in a lower.[21] The rest come up in his *Treatise on Demonstration*, the second in the response to whether every demonstration must be made from immediate premises. Galileo argues (with Aristotle) that it must, and in reply to an objection asserts that "a subalternated science is imperfect and does not have perfect demonstrations, since it presupposes its first principles as proved in the higher science." Thus, he concludes, "it generates knowledge from a supposition and in a qualified way."[22] The other two passages occur in the response to the question of whether a demonstration is better if made from premises that are better known, and whether knowledge of the premises is better and more perfect than knowledge of the conclusion. In listing what makes knowledge better, Galileo argues that knowledge in an independent science is better than that in a dependent one, citing the subalternating sciences as independent and implying that the subalternated are not. Certitude is another of the criteria, and in discussing it Galileo notes that although everything that is evident is held with certainty, the converse is not always the case. For example, in the subalternated sciences we can be certain about something without its being evident—presumably because the principles, coming from the higher science, are not evident in the lower. But he adds that this is also the case "more clearly in our faith," meaning (I think) that we similarly hold with certainty the articles of Christian faith, which are also not evident to us.[23]

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[16] See Franciscus Toledo, *Introductio in universam Aristotelis logicam*, in *Opera omnia philosophica*, 5 vols., Cologne 1615-16; repr in facsimile, Hildesheim/Zurich/New York 1985, vol. 1, 330-6, 355; and Benito Pereira, *De communibus omnium rerum naturalium principijs & affectionibus libri xv*, Venice 1586, 79.

[17] On Carbone's plagiarism, see Wallace, *Galileo and His Sources* (as note 4), 16-20.

[18] Ludovico Carbone, *Introductionis in universam philosophiam libri quattuor*, Venice 1599, 262-88, especially 275 and 281.

[19] See Wallace's discussion, based on Carbone, *Introductio in philosophiam*, Venice 1599, in *Galileo's Logic of Discovery and Proof* (as note 4), 102-11; Wallace notes Carbone's "ambivalence" about the use of causes in the middle sciences, especially astronomy (111).

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[20] See Wallace, *Galileo and His Sources* (as note 4), 33-51.

[21] *Tractatio de praecognitionibus* (as note 5), 7; tr. W. A. Wallace, in: *Galileo's Logical Treatises* (as note 5), 91.

[22] *Tractatio de demonstratione* (as note 5), 58; tr. Wallace, in: *Galileo's Logical Treatises* (as note 5), 146; in the last phrase (*gignat scientiam ex suppositione et secundum quid*) I have substituted "knowledge" for Wallace's "a science". Wallace has argued that Galileo came, at least in his later writings, to attribute full demonstrative force to some arguments *ex suppositione*: see W. A. Wallace, "Galileo and Reasoning *Ex suppositione*: The Methodology of the *Two New Sciences*," in: R. S. Cohen, et al., (eds.), *Proceedings of the 1974 Biennial Meeting of the Philosophy of Science Association*, Dordrecht-Boston 1976, 79-104; "Aristotle and Galileo: The Uses of ΥΠΟΘΕΣΙΣ (*Suppositio*) in Scientific Reasoning," in: D. J. O'Meara (ed.), *Studies in Aristotle* (Studies in Philosophy and History of Philosophy 9), Washington 1981, 47-77; and especially "Galileo and Reasoning *ex suppositione*," in: Wallace, *Prelude to Galileo* (as note 4), 129-59.

This is the extent of Galileo's notes on the Aristotelian methodology of the mixed sciences. Cursory though they are, they show that in compiling these notes Galileo took from his sources the rather discouraging conclusions that the mixed sciences enjoy only imperfect demonstrations, that because they are dependent on pure mathematics they generate knowledge only in a qualified way, and that the knowledge so generated is similar to faith in that it is certain without being evident. Perhaps these notes represent only the common opinion and not Galileo's own; if so, they were, as Favaro and Randall thought, the work only of his hand and not of his head, and so should have had little influence on his later work. In any case, they do not seem the materials out of which Galileo might have forged a new, demonstrative mixed science.

For in his new science of motion, as well as in astronomy, Galileo was not content with imperfect science, with knowledge "in a qualified sense" generated from imperfect demonstrations and based on premises that may be certain but are not evident. Throughout his career Galileo held to the ideal that science must proceed through certain demonstrations from evident principles. His methodological difficulty was not so much with the certainty of the demonstrations as with the evidence of the principles: how are such principles to be found and made evident? In his first works on motion—the *Dialogue on Motion* and the *Treatise on Motion* (*De motu antiquiora*), both composed around 1589-92— Galileo seeks to explain the motion of heavy and light bodies in terms of the relation of their specific gravities to those of the media through which they move. He conceives of the medium not as resistant, but as buoyant, and applies Archimedean hydrostatics to falling bodies.[24] In the *Dialogue* Galileo makes his method explicit:

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[23] *Tractatio de demonstratione* (as note 5), 65-9; tr. Wallace, in: *Galileo's Logical Treatises* (as note 5), 150-3.

[24] Galileo, *De motu*, in *Le Opere di Galileo Galilei*, ed. A. Favaro, Edizione Nazionale, 20 vols. in 21, Florence 1890-1909, repr. 1964-66 (hereafter cited as *Opere*), 1: 251-419; tr. in: I. E. Drabkin and S. Drake, *Galileo on Motion and Mechanics*, Madison 1960, 3-123; *Dialogus de motu*, in *Opere*, 1: 368-408; tr. in S. Drake and I. E. Drabkin, *Mechanics in Sixteenth-Century Italy*, Madison 1969, 329-77.

> Now at last I can no longer avoid demonstrating some theorems to you. From the comprehension of these theorems you will clearly understand not only the answer to your question [why a pebble falls in water], but also the ratio of the speed or slowness of the motion of bodies both heavy and light, as well as the ratio of the heaviness or lightness of one and the same body weighed in different media. All these theorems had to be demonstrated when I tried to find the true reasoning by which, in a mixture of two metals, we could indicate the exact amount of each separate metal [i.e., Archimedes' crown problem]. For these theorems (though they are not different from those demonstrated by Archimedes) I shall adduce proofs that are less mathematical and more physical. And I shall use assumptions that are clearer and more obvious to the senses than those which Archimedes embraced.[25]

Through a series of propositions concerning floating and sinking bodies, Galileo arrives at the conclusion "that a solid heavier than water is lighter in water than in air by the weight, in air, of a volume of water equal to the volume of the solid," which is the principle of the hydrostatic balance and the "true reasoning" he referred to above for solving the crown problem. Galileo then generalizes this conclusion so that it can be used as a principle in the motion of heavy and light bodies:

> Now all the demonstrations made with respect to water as a medium must also be understood as applying to air as a medium. And from this the general conclusion is obvious; that [in natural motion] bodies heavier than the medium through which they must move, move downward, while bodies lighter than the medium through which they must move, move upward.[26]

This last, then, is the mathematical-physical principle of his nascent science of motion. In these methodological statements Galileo expresses no concern with the relation between the subject matter of this science and that of geometry, nor with whether the demonstrations using this principle will be *quia* or *propter quid*, nor even with what causes they might be made through. He is concerned rather with finding proofs that are "less mathematical and more physical" than those of Archimedes, and with establishing principles that are "clearer and more obvious to the senses."

Though he later abandoned the hydrostatic approach to falling bodies, he shows the same methodological concern when he stating his difficulties with falling bodies in the famous letter to Paolo Sarpi of 1604. Having already discovered the double-distance rule and the odd-number rule, Galileo was again seeking "a totally indubitable principle that can be put as an axiom," from which, once posited, these rules can be demonstrated.[27] The principle he hit upon there—that the speeds of a naturally falling body are proportional to the distances fallen—was later abandoned. Nevertheless, again we find Galileo looking for a mathematical-physical principle or axiom upon which to found his new science.

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[25] *Opere*, 1: 379; tr. Drake and Drabkin (as note 24), 344.

[26] *Opere*, 1: 384; tr. Drake and Drabkin (as note 24), 349.

In such efforts Galileo was criticized especially by natural philosophers for illegitimately applying mathematics to natural philosophy. If Galileo had been following the accepted Aristotelian methodology of the mixed sciences in his later works, he might be expected to have rebutted these critics by citing Aristotle against them. The common opinion on the use of mathematics in physical questions was expressed by Vincenzo di Grazia, professor of philosophy at the University of Pisa and a committed Aristotelian, in his 1613 response to Galileo's *Discourse on Floating Bodies*:

> Before we consider Galileo's demonstrations, it seems necessary to prove how far from the truth are those who wish to prove natural facts by means of mathematical reasoning, among whom, if I am not mistaken, is Galileo. All the sciences and all the arts have their own principles and their own causes by means of which they demonstrate the special properties of their own object. It follows that we are not allowed to use the principles of one science to prove the properties of another. Therefore anyone who thinks he can prove natural properties with mathematical arguments is simply demented, for the two sciences are very different. The natural scientist studies natural bodies that have motion as their natural and proper state, but the mathematician abstracts from all motion.[28]

Perhaps the mixed sciences have slipped di Grazia's mind here. But neither does Galileo's reply, delivered through Castelli, mention the mixed sciences: Castelli simply denied that Galileo had used mathematical principles at all, and asserted that all the physical bodies in the *Discourse* were treated as conjoined to motion and sensible material,[29] as was expected in natural philosophy. Perhaps Galileo is deliberately obscuring his use of mathematics here, or perhaps he does not remind such critics of the mixed sciences because he knows that the general understanding of Aristotle's views of them is not in his favour.

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[27] "Galileo a Paolo Sarpi," in: *Opere*, 10: 115-6; for a translation and discussion of this letter, see S. Drake, *Galileo at Work: His Scientific Biography*, Chicago 1978, 100-3.

[28] Vincenzo di Grazia, *Considerazioni sopra il discorso di Galileo Galilei*, Florence 1613, in Galileo, *Opere*, 4: 385; tr. in: W. R. Shea, *Galileo's Intellectual Revolution*, New York 1972, 34-5.

[29] Galileo, *Opere,* 4: 697; see the discussion and quotation in Drake, *Galileo at Work* (as note 27), 220.

Among the Jesuits, however, there are at least two later exceptions to the generally disparaging opinion about mathematical demonstrations in the mixed sciences. About the same time that Galileo was working out his new, mathematical science of motion, the Jesuit mathematician Giuseppe Biancani (Josephus Blancanus) showed a rare confidence in the demonstrative power of the mixed sciences. Biancani, who was a student of Christopher Clavius at the Collegio Romano and who later taught mathematics at the University of Parma, took up the defence of mathematics against the attacks of Piccolomini and Pereira.[30] Like Clavius before him, Biancani defended mathematics more with rhetoric and examples than with detailed expositions of Aristotle. Nevertheless, in the *Aristotelis loca mathematica*, published in 1615, Biancani gives a passage-by-passage vindication of Aristotle's high regard for mathematical demonstration. And in his *De mathematicarum natura dissertatio*, a defence of mathematics printed with the *Loca mathematica*, Biancani turns to advantage all the apparent disadvantages of the mixed sciences. There he asserts that the mixed sciences demonstrate through causes, and that the practical mathematical sciences, since they involve both physical things and human purposes, demonstrate from all four genera of cause. Thus Biancani can boldly assert that mathematics as a whole enjoys the most perfect and powerful demonstrations.[31] But he has not solved the difficulties raised in the commentaries on the *Posterior Analytics*, and his influence on Galileo remains conjectural.[32]

The second exception is found in Valla's *Logica*, published in 1622. There Valla revised his earlier conclusions (represented in Carbone's plagiarism) to assert that the optical scientist, through his own knowledge of geometry, can arrive at *a priori* and *propter quid* demonstrations.[33]

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[30] On Biancano, see Wallace, *Galileo and His Sources* (as note 4), 141-6; Giacobbe, "Epigoni nel Seicento della *Quaestio de certitudine mathematicarum*: Giuseppe Biancani" (as note 15); on the debate over the certitude of mathematics, see the other works cited in note 15 above.

[31] Blancanus, *Aristotelis loca mathematica*, Bologna 1615, 53-4; *De mathematicarum natura dissertatio* (published with the *Aristotelis loca mathematica)*, Bologna 1615, 24, 29-31.

[32] On Galileo's relations with Biancano, see Wallace, *Galileo and His Sources* (as note 4), 269.

[33] Ibid., 134.

Since the *Logica* was not written until at least after Carbone's plagiarism in 1597, which it refers to, and not published until 1622, its influence on Galileo is also uncertain. Perhaps in the case of Valla, as well as Biancani, the influence was the other way around.

When Galileo finally returned to write his definitive account of the new science of motion after more than twenty years of astronomical controversies and other distractions, he explicitly stated that the other mathematical sciences were his model. Embedded within the dialogue of the Third Day of his *Discourses on Two New Sciences* (1638), the new science is presented in a Latin treatise that proceeds deductively from definitions, axioms, and postulates to theorems and problems in the manner of Euclid and Archimedes. One of the key definitions is of uniformly accelerated motion:

> I say that that motion is equably or uniformly accelerated which, abandoning rest, adds on to itself equal momenta of swiftness in equal times.

From this and an assumption about motion on inclined planes, Galileo deduces the odd-number rule, the times-squared rule, and other conclusions that he has found out independently. But he has not yet shown that this definition, "conceived and assumed in the abstract," as Sagredo says, "is adapted to, and verified in the kind of accelerated motion that heavy bodies in fact employ in falling naturally."[34] Simplicio asks for some experiential confirmation, to which Salviati replies:

> Like a true scientist [*scienziato*], you make a very reasonable demand, for this is usual and necessary in those sciences which apply mathematical demonstrations to physical conclusions, as may be seen among writers on optics, astronomers, mechanics, musicians, and others who confirm with sensory experiences their principles that are the foundations of all the resulting structure.[35]

Galileo's problem, then, was not how to apply mathematical principles to demonstrations within this new science, or whether the resulting demonstrations were certain, or *quia,* or *propter quid.* For, unlike the Aristotelian commentators, Galileo never seemed to doubt the demonstrative force of mathematics in the mixed sciences; his problem was with the mixed principles of such demonstrations—how to find and ground through "sensory experiences" the "indubitable principle" that naturally accelerated motion was in fact equally accelerated. This principle did not descend from a different science, as the Aristotelian commentators conceived of mathematical principles used in the mixed sciences. Nor was it the purely physical cause that Grosseteste and most others had in mind when they insisted that only the natural philosopher could know *propter quid* in the mixed sciences, for Galileo was expressly silent on the physical cause of accelerated motion.[36] Rather, this principle was both mathematical and physical—a mathematical property (uniform acceleration) predicated of a physical subject (falling bodies)—and it was posited within the science of motion, served as the premise in those demonstrations, and was "the foundation of all the resulting structure," including the odd-number rule and the times-squared law. Athough this principle lay outside of the deductive structure of the science—no science can prove its own principles—it nevertheless was not merely an arbitrary assumption or hypothesis. Like the corresponding principles of astronomy, optics, harmonics, and mechanics, it had to be established from "sensory experiences," in this case from experiments with inclined planes, and through an intricate logic of inference.[37] Perhaps here, as Wallace has argued, Galileo followed the method of *regressus*, developed by Paduan Aristotelians such as Zabarella and passed on through lectures by Jesuits at the Collegio Romano.[38] But whether he was also indebted to

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[34] Galileo, *Opere*, 8: 198; tr. S. Drake, *Two New Sciences*, Madison 1974, Toronto ²1989, 154-5.

[35] Galileo, *Opere*, 8: 212; tr. Drake (as note 34), 169: "Voi, da vero scienziato, fate una ben ragionevol domanda; e così si costuma e conviene nelle scienze le quali alle conclusioni naturali applicano le dimostrazioni matematiche, come si vede ne i perspettivi, negli astronomi, ne i mecanici, ne i musici ed altri, li quali con sensate esperienze confermano i principii loro, che sono i fondamenti di tutta la seguente struttura" (I have slightly altered Drake's translation of the last two clauses to make it clear that the principles, not the sensory experiences, are the foundations of the science).

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[36] Galileo, *Opere*, 8: 202; tr. Drake (as note 34), 158-9. The seventeenth-century Jesuit Honoré Fabri later attempted a causal analysis of Galileo's science of motion; see D. C. Lukans, "An Aristotelian Response to Galileo: Honor Fabri, S. J., on the Causal Analysis of Motion," PhD thesis, Univ. Toronto 1977.

[37] On Ptolemy's similiar, though unsuccessful, search for a law of refraction, see A. M. Smith, "Ptolemy's Search for a Law of Refraction: A Case-Study in the Classical Methodology of 'Saving the Appearances' and its Limitations," in: *Archive for History of Exact Sciences* 26 (1982), 221-40; see also idem, "Saving the Appearances of the Appearances: The Foundations of Classical Geometrical Optics," in: *Archive for History of Exact Sciences* 24 (1981), 73-100.

[38] See Wallace, *Galileo's Logic of Discovery and Proof* (as note 4), 238-98; cf. W. L. Wisan, "Galileo's Scientific Method: A Reexamination," in: *New Perspectives on Galileo* (as note 4), 1-57, esp. 40-3; and idem, "The New Science of Motion: A Study of Galileo's *De motu locali*," in: *Archive for History of Exact Sciences* 13

Zabarella for his confidence in the demonstrative certainty of the mixed sciences remains in doubt, for he would not have found it in his Jesuit sources.

When Aristotelian commentators thought about the mixed sciences, they often had astronomy in mind. And it was well known that the principles of astronomy—epicyles, deferents, uniform circular motions, and the like—are merely mathematical fictions or hypotheses invented for convenience in calculation and to save the appearances. Galileo was dissatisfied with such shaky foundations, and he sought to make the principles of astronomy more evident and true by confirming the true principle from which all the conclusions in the science would follow.[39] This principle, like the definition of gravitational motion as uniformly accelerated, was a mathematical-physical principle: that the earth rotates daily and moves annually about the sun. In attempting to confirm it Galileo spent much of his life and ultimately lost his freedom. For Galileo, the conclusive proof that the earth moves—it was no more entertained by him as a mere hypothesis than it was by Copernicus—lay not in the astronomical conveniences it introduced, nor the phases of Venus, the motions of sunspots, or his other telescopic discoveries, but in the tides. Since the tides were the physical result of the motion of the earth (or so Galileo thought), they confirmed that in fact the earth moves, just as the distances measured on inclined planes were the result of uniformly accelerated motion and so confirmed that free fall was in fact uniformly accelerated.

(1974), 103-306, especially. 120-5; N. Jardine, "Galileo's Road to Truth and the Demonstrative Regress," in: *Studies in History and Philosophy of Science* 7 (1976), 277-318; and G. Hatfield, "Metaphysics and the New Science," in: D. C. Lindberg and R. S. Westman (eds.), *Reappraisals of the Scientific Revolution*, Cambridge 1990, 93-166, especially 126-8.

[39] In a well known passage of the *Dialogue Concerning the Two Chief World Systems* Galileo suggests that while the astronomer who uses arbitrary assumptions to save the appearances may be content merely as a calculating astronomer, he will not be satisfied as a philosophical astronomer (*astronomo filosofo*) unless his suppositions are also true in nature (Galileo, *Opere*, vii, 369; tr. S. Drake, *Dialogue Concerning the Two Chief World Systems*, Berkeley/Los Angeles/London 1967, 341); Galileo made the same point in 1613 in his first letter on sunspots, *History and Demonstrations Concerning Sunspots and their Phenomena*, in *Opere*, 5: 102; tr. S. Drake, *Discoveries and Opinions of Galileo Galilei*, New York 1957, 96-7; see Wallace, "Galileo and Reasoning *ex suppositione*," in: *Prelude to Galileo* (as note 22), 138-140.

Galileo's ideal of a mathematical science firmly grounded on evident principles was far different from the idea of the mixed sciences developed within the Aristotelian methodological tradition and passed on by his Jesuit predecessors.[40] Perhaps with astronomy as their example, they were content to grant mathematical principles as convenient but fictional hypotheses, and then worried over the status of demonstrations made from borrowed premises. Galileo, in contrast, knew that the demonstrations would be sound, but only if they proceeded from true and evident principles, the search for which was his main methodological concern. The limitations and concerns of the methodological tradition of mixed sciences, as conveyed to Galileo by the Jesuits, could not assist him in this pursuit.

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[40] Wallace notes that there is a discontinuity between Galileo's ideal of a demonstrative, mathematical science and his predecessors' idea of a subalternated science as "somewhat deficient, a *scientia secundum quid*". The break, Wallace says, is "almost too subtle to be recognized" [*Galileo's Logic of Discovery and Proof* (as note 4), 301-2].

FLAMINIO PAPAZZONI: UN ARISTOTELICO BOLOGNESE MAESTRO DI FEDERICO BORROMEO E CORRISPONDENTE DI GALILEO

Michele Camerota

Il 12 gennaio del 1611, Belisario Vinta, Segretario di Stato del Granducato di Toscana, scriveva, da Pisa, a Galileo in Firenze, per domandargli notizie di un certo «Sig. Dottor Papazzoni». Il motivo della richiesta era strettamente pertinente alla destinazione della cattedra di Filosofia dell'università pisana, improvvisamente liberatasi in seguito al recente decesso (dicembre 1610) del suo titolare, il fiorentino Giulio Libri.[1] Il Vinta, rimarcando l'urgenza della questione, sollecitava informazioni tempestive circa l'età del Papazzoni, il trattamento economico riservatogli presso lo Studio di Bologna (in cui insegnava Filosofia) e le eventuali, sue aspettative in merito alla lettura pisana, non mancando peraltro di domandare se il candidato fosse di «buona et robusta sanità da poter durar fatica nel leggere».[2] Ottemperando all'invito di una pronta replica, Galileo rispondeva esattamente quattro giorni dopo:

> Non posso per hora satisfare -scriveva lo scienziato pisano- se non ad una parte delle dimande di V. S. Ill.^{ma} intorno al S. Papazzoni: ciò è che è di età di circa

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[1] Commentandone la scomparsa, Galileo, in una lettera a Paolo Gualdo del 17 dicembre 1610, così si esprimeva: «A Pisa è morto il filosofo Libri, acerrimo impugnatore di queste mie ciancie, il quale, non le havendo mai voluto veder in terra, le vedrà forse nel passar al cielo.» G. Galilei, *Opere*, 20 voll., Firenze 1890-1909 (rist. 1968), X, 484.9-11. (Indicheremo direttamente il riferimento alla pagina. Esso sarà talvolta accompagnato da un rimando al numero di riga, la cui segnalazione verrà preceduta da un punto.)
Sulla figura di Giulio Libri (c. 1550-1610), A. Fabroni, *Historia Academiae Pisanae*, Pisis, 1791-95, II, 355-6; G. Negri, *Istoria degli scrittori fiorentini*, Ferrara, 1722, 309; E. Garin, *Scienza e vita civile nel Rinascimento italiano*, Laterza, Bari, 1965 (1985/5), 113, 123-4, 140; C. B. Schmitt, "The Faculty of Arts at Pisa at the Time of Galileo" in: *Physis* 14 (1972), 265-6.

[2] Galilei, *Opere* (cit. n. 1), XI, 20-1.

> 60 anni, al mio giudizio, di complessione però assai robusta, gioviale [et] di graziosa conversazione, per quanto lo conobbi nel passare per Bologna 8 mesi sono. Quale stipendio habbia quivi –soggiungeva tuttavia Galileo– o quello che ei pretenda altrove, io non so:..[3]

Galileo esprimeva dunque un giudizio tutto sommato positivo su quel candidato alla cattedra di Filosofia a Pisa, di cui –ci dice– aveva fatto diretta conoscenza nel corso di un recente soggiorno a Bologna.

Sulla base dell'esplicita indicazione temporale («8 mesi sono»), la circostanza dell'incontro col Papazzoni, appare facilmente identificabile con la sosta nella città felsinea effettuata -di ritorno a Padova dalla Toscana- nei giorni 24 e 25 aprile 1610. In quell'occasione, Galileo -ospite nella casa dell'astronomo Giovanni Antonio Magini- tentò di offrire una pubblica dimostrazione della potenza del suo cannocchiale, mostrando ad uno scelto novero di dotti i satelliti di Giove. In base alle cronache rimasteci, tuttavia, la prova si risolse in un cocente fallimento per lo scienziato pisano. Secondo il resoconto fornito dal Magini: «magis quam 20 viri doctissimi aderant, nemo tamen planetas novos perfecte vidit.»[4] Mentre Martino Horky, strenuo oppositore del Galilei, e anch'egli presente quella sera, afferma che della cattiva riuscita delle osservazioni telescopiche potevano testimoniare: «excellentissimos viros et nobilissimos doctores», i quali: «una mecum praesepe [forse "persaepe"] in caelo eadem nocte 25 Aprilis, praesente ipso Galileo, observarunt; sed omnes instrumentum fallere confessi sunt.»[5]

Se, come pare assai probabile, Papazzoni fu tra i circa venti *nobilissimi doctores* che assistettero all'evento, l'incontro -vista soprattutto la sfortunata *performance* dello strumento- non dovette certo risultare decisivo nel convincerlo della correttezza delle nuove tesi galileiane. Tanto più che -come si ricava da una lettera di Martin Hasdale a Galileo del 28 aprile 1610- il suo orientamento era già nettamente improntato a critica e polemica nei confronti delle recenti scoperte telescopiche. Hasdale -riassumendo una comunicazione ricevuta dal

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[3] Ibid., XI, 26-7.

[4] Ibid., X, 359.

[5] Ibid., X, 343.25-7. Galileo registrò tuttavia nei suoi appunti che la sera del 24 erano osservabili due satelliti, mentre il giorno successivo fu possibile scorgerli tutti e quattro. Ibid., III, 436. Probabilmente la visione non fu abbastanza nitida, e lasciò scettici gli astanti.

Magini- informa infatti che Papazzoni avrebbe avuto l'intenzione di impugnare pubblicamente il *Sidereus Nuncius*:

> Sono molti altri -dichiara il tedesco- che oppugnano questa openione del Gallilei [sic], et tra gli altri il Dottore Papazzone voleva *ex professo* nelle scuole publiche confutare tutto il libro; ma le lettioni si sono finite più presto del solito: ma spero che subito dopo l'ottava di Pasqua eseguirà il suo intento.[6]

Eppure, come abbiamo visto, Galileo esprimeva un parere abbastanza lusinghiero sul Papazzoni, e -come constateremo in seguito- sarà proprio per suo merito precipuo se il filosofo bolognese riuscirà ad ottenere la lettura pisana.

Ma, chi era veramente Papazzoni? Da quale contesto emergeva, e di che genere di istanze culturali era portatore? Quali erano i suoi trascorsi biografici e professionali, i suoi interessi e la sua attività erudita, prima di arrivare ad intersecare la prestigiosa parabola biografica galileiana?

Porsi domande simili non sembra affatto fuori luogo, in un campo di indagine -quello degli studi galileiani- in cui, nonostante l'enorme quantità di ricerche svolte da Antonio Favaro alla fine del secolo scorso, e le successive, importanti integrazioni per opera di altri validissimi ricercatori, rimaniamo ancora lontani dal poter vantare una conoscenza articolata e precisa dell'ambiente intellettuale e dei personaggi che lo costituivano.

Da questo punto di vista, anche le ricerche su figure marginali o di contorno possono offrire un positivo contributo informativo alla delineazione del composito e, per molti aspetti, controverso quadro culturale che fece da sfondo alla vicenda scientifica galileiana. In effetti, come, già venti anni fa, rilevava, con la consueta chiarezza ed incisività, Charles Schmitt:

> In order to understand Galileo and his accomplishment, we must study not only the writings of the man himself and the documents which specifically name him, but we must look elsewhere as well. We must understand his predecessors and contemporanies, for only then we can know precisely what his accomplishment was. By a careful consideration of his teachers, friends and enemies can we come to a fuller understanding of his own thought, of how it was original and how it was traditional.[7]

E' dunque in riferimento ad un simile sforzo di penetrazione storica sempre più puntuale e minuziosa dell'ambiente in cui Galileo visse ed operò, che non ci pare inutile lo studio di un autore minore quale sicuramente fu Flaminio Papazzoni.

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[6] Ibid., X, 345.27-31.

[7] Schmitt (cit. n. 1), 244.

Personaggio stimato dai contemporanei, ma che non può certo dirsi di primissimo piano -anche nell'ambito dell'aristotelismo accademico cui pure apparteneva per cultura e professione- Papazzoni si era formato allo Studio di Bologna, sua città natale, conseguendo la laurea in Medicina il 16 dicembre 1572 e in Filosofia il 16 aprile del 1573, e iscrivendosi quindi ai Collegi medico e filosofico il 29 novembre 1576.[8]

Non conosciamo la data della sua nascita. Sulla base della testimonianza di Galileo («è di età di circa 60 anni»), e di una identica attestazione del suo corrispondente Giovanni Antonio Roffeni (professore bolognese e amico del Papazzoni),[9] e considerando anche il riscontro relativo all'ottenimento delle insegne dottorali (1572-1573), possiamo congetturare che, assai verosimilmente, sia venuto al mondo negli anni attorno al 1550. Il suo vero cognome era Volpi o Dalla Volpe,[10] ma, probabilmente, assunse il nome di famiglia della madre, la quale apparteneva appunto al ceppo dinastico dei Papazzoni.[11] Lui stesso racconta di aver studiato con Cesare Fantuzzi e col ben più famoso Federico Pendasio,[12] del cui magistero andava talmente orgoglioso da affermare di non provare alcuna invidia per Alessandro Magno, discepolo di Aristotele.[13] In realtà, il suo apprendistato filosofico col Pendasio dovette esser piuttosto breve, dal momento che il maestro mantovano giunse a Bologna nell'autunno del 1571 (il Senato bolognese ne ratificò il contratto il 29 ottobre), mentre –come detto– il Papazzoni si laureò il 16 aprile 1573. In ogni caso, con entrambi i suoi insegnanti (Fantuzzi e Pendasio) Papazzoni finì per legarsi da un vincolo di vera, strettissima amicizia.[14] Dopo aver completato gli studi, sappiamo che lesse Logica a

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[8] Per le notizie biografiche sul Papazzoni, cfr. le seguenti fonti: G. N. Alidosi, *I Dottori Bolognesi di Teologia, Filosofia, Medicina, e d'Arti liberali dall'anno 1000 per tutto Marzo del 1623*, Bologna, 1623, 69-70; A. Bumaldi, *Minervalia Bonon. Civium anademata, seu Bibliotheca Bononiensis*, Bononiae, 1641, 68-9; G. Fantuzzi, *Notizie degli scrittori bolognesi*, Bologna, 1788, 7 voll. [rist. Bologna, 1965], VI, 278-80; A. Fabroni, *Historia*, (cit. n. 1), II, 377-8; S. Mazzetti, *Repertorio di tutti i professori antichi e moderni della famosa Università e del celebre Istituto delle Scienze di Bologna*, Bologna, 1847, 108; idem, *Alcune aggiunte e correzioni alle opere dell'Alidosi, del Cavazza, del Sarti, del Fantuzzi e del Tiraboschi, per quella parte soltanto che tratta de' Professori dell'Università di Bologna*, Bologna, 1848, 70, che emenda alcune imprecisioni dei testi precedentemente citati; Galilei, *Opere* (cit. n. 1), XX, 503.

[9] «...non sarebbe suo [del Papazzoni] decoro l'uscire fuori ad una cattedra, in età d'anni 60» Galilei, *Opere* (cit. n. 1), XI, 128.11-2 (lett. a Galileo del 18 giugno 1611). G. A. Roffeni fu autore di una *Epistola Apologetica* contro M. Horky, e in difesa del *Sidereus Nuncius.* Cfr. ibid., III, 191-200. In essa, egli dichiara esser stato Papazzoni a mostrargli per primo l'opera dell'Horky. Cfr. ibid., III, 195.5-7.

[10] «Flaminius Papazonius, quondam Illustris Domini Alexandri De Vulpe» si legge in documento notarile (cfr. Galilei, *Opere* (cit. n. 1), XIX, 270); «Flaminius de Vulpe» lo nomina il Bumaldi (cit. n. 8), 68; «Flaminio d'Alessandro dalla Volpe», secondo l'Alidosi (cit. n. 8), 69; «figliolo d'Alessandro Volpi ovver dalla Volpe», lo dice il Fantuzzi (cit. n. 8), VI, 278.

[11] «Fu poi cognominato Papazzoni per causa della madre...» Alidosi (cit n. 8), 69. Secondo il Fantuzzi, Flaminio ottemperò in ciò ad una richiesta materna: «cangiò cognome a sollecitazion della madre, o perchè questa donna gli portò forse in casa il retaggio di un ramo de' Papazzoni, che in lei s'estinguesse, o

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perchè la femminil vanità la traesse ad ostentare un cognome più nobile di quello del marito.» Fantuzzi (cit. n. 8), VI, 278. In effetti, nell'orazione funebre da lui tenuta in memoria del collega Cesare Fantuzzi, Papazzoni ricorda la grande amicizia che legava il defunto al suo avo Ludovico Papazzoni, confermando così, indirettamente, che l'assunzione del nuovo cognome aveva un fondamento in qualche ramo del suo albero genealogico. Cfr. Papazzoni, *Deploratio Flaminii Papazonii in Caesaris Elephantutij eiusdem collegae obitum*, in: *Caesaris Elephantutij Viri nobilissimi Philosophiae et Medicinae doctrina suis temporibus celeberrimi Almi Artistarum Collegij Bononiensis Decani Funus*, Bononiae, 1607, 39.

[12] Cfr. Papazzoni, *Eius qui insignia contulit* [i. e. Papazzoni] *Oratio*, in *Orationes habitae Bononiae in Doctoratu Illustriss. et Excellentiss. D. D. Caesaris Pendasii*, Bononiae, 1601, 11; Papazzoni 1607 (cit. n. 11), 40-1.
Cesare Fantuzzi, cieco fin dalla prima infanzia, nacque a Bologna nel 1534. Conseguì la laurea in medicina il 1 marzo 1567, e l'anno successivo cominciò ad insegnare Logica nell'Ateneo bolognese, passando poi, nel 1569, alla cattedra di Filosofia, lettura che tenne fino al 1584. Morì il 6 luglio 1606. Su Fantuzzi cfr. Alidosi (cit. n. 8), 44; Mazzetti, 1847 (cit. n. 8), 120.
Su Federico Pendasio (m. 1603), professore a Mantova, Pavia, Padova e Bologna, maestro del Cremonini, noto anche per le polemiche con Zabarella e F. Piccolomini, cfr. i riferimenti bibliografici offerti in C. H. Lohr, *Latin Aristotle Commentaries. II. Renaissance Authors*, Firenze, 1988, 305, cui sono da aggiungere le considerazioni di L. Olivieri, *Certezza e gerarchia del sapere. Crisi dell'idea di scientificità nell'aristotelismo del secolo XVI*, Padova, 1983, *passim* (che pubblica anche alcuni inediti del Pendasio, 187-95), e le ricerche di P. Ventrice, *La discussione sulle maree tra astronomia, meccanica e filosofia nella cultura veneto-padovana del Cinquecento*, Istituto Veneto di Scienze Lettere e Arti, Memorie della classe di Scienze fisiche, matematiche e naturali, XXXIV, fasc. III, Venezia 1989, 163-82, 189-90 (sulla controversia tra Zabarella e Pendasio a proposito delle scienze "medie").

[13] «Neque ea in re Alexandro invideo qui gloriabatur, quod Aristotelis tempore natus de illius ore philosophiam perceperit, nam si ipsi ab Aristotele, mihi Federico Pendasio perinde ac ab illius anima eandem Philosophiam imbibere contigit.» Papazzoni 1601 (cit. n. 12), 14.

[14] «Usus ergo sum Caesare Elephantutio, et in Logica et in Philosophia. Hic me ad Pendasium deduxit, a quibus utrisque ita fui semper ex animo amatus, ut nos non discipulorum, et praeceptorum nodus, sed amicorum indissolubilis necessitudo

Bologna dal 1574 fino al 1576-77, passando poi, negli anni tra il 1577 e il 1579-80, ad insegnare Filosofia. Nella primavera del 1579 cominciò ad insegnare privatamente Logica al giovane Federico Borromeo, il quale –appena quattordicenne– era stato, proprio nell'aprile di quell'anno, inviato a studiare a Bologna dal cugino, S. Carlo Borromeo.[15]

L'incontro col futuro Cardinale Federico, segnerà una lunga (quasi un decennio) e cruciale fase dell'esistenza del Papazzoni. Di questo periodo rimangono alcune significative testimonianze nella corrispondenza del giovane Borromeo con i familiari, e, in particolare, col cugino Carlo. Così, dalla lettera di Federico a Carlo Borromeo del 13 settembre 1579, apprendiamo che il Papazzoni era stato colpito da una malattia piuttosto seria e di difficile e lunga guarigione («ex grave et diuturno morbo»), tanto che, per qualche tempo, lo si dovette provvisoriamente sostituire con un altro maestro di Logica.[16] Fortunatamente il malanno non si dimostrò, però, dei più gravi, talchè, esattamente un mese dopo, Federico poteva informare Carlo che il suo maestro Papazzoni «optime convaluit».[17] Dalle lettere emerge in modo chiaro l'affetto e la stima di cui il filosofo bolognese godeva presso i Borromeo. E' proprio in virtù di questo apprezzamento che il giovane Federico si rivolge più volte al cugino cardinale per raccomandare la causa del Papazzoni, impegnato nella richiesta di un migliore trattamento economico, e insidiato dalle gelosie di una parte del mondo accademico felsineo.[18]

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vinciret, diuturna et constans donec illi vixerunt.» Papazzoni 1607 (cit. n. 11), 40-1. Il legame era tale che, secondo una notizia fornitaci dal Fantuzzi, alla sua morte, nel 1603, Pendasio fu seppellito nell'arca funeraria del Papazzoni. Cfr. Fantuzzi (cit. n. 8), VI, 342.

[15] Cfr. F. Rivola, *Vita di Federico Borromeo*, Milano, 1656, 25; C. Castiglioni, *Il Cardinale Federico Borromeo*, Torino, 1931, 20.
Il Borromeo sentiva anche le pubbliche lezioni del Pendasio. Sulla formazione intellettuale di F. Borromeo non siamo purtroppo riusciti a vedere l'importante studio di R. Majocchi e A. Moiraghi, *Federico Borromeo studente e gli inizi del Collegio*, Pavia, 1916, che potrebbe contenere interessanti, ulteriori notizie sul magistero del Papazzoni.

[16] Cfr. C. Marcora, *Lettere del Cardinale Federico Borromeo ai familiari*, Como, 1978, vol. II, 11; A. Sala, *Documenti circa la vita e le gesta di S. Carlo Borromeo*, 3 voll., Milano, 1857-1861, III, 692. Cfr. inoltre F. Rivola (cit. n. 15), 25-6.

[17] Cfr. Marcora (cit. n. 16), 13; Sala (cit. n. 16), III, 693.

[18] Cfr. le lettere di Federico a Carlo Borromeo del 30 settembre e del 18 novembre1579, pubblicate in Marcora (cit. n. 16), 12 e 14-5, e in Sala (cit. n. 16), III, 691-2, 695-6.

La corrispondenza ci offre –nella lettera di Federico del 18 gennaio 1580– anche un'interessante testimonianza circa i modi dell'insegnamento del Papazzoni, e circa la sua capacità di semplificare e chiarire le complesse tematiche della logica aristotelica:

> Cum studiis meis agitur, -nota Federico Borromeo- ut antea saepius ad te scripsi, nimirum satis praeclare ac, ut reliquas eorum partes quibus singulis duas diei horas tribuo, mittam, in logicae facultatis cursu eo processimus, ut ad libros analiticos posteriores, ut appellant, in quibus de demonstratione agitur, dies abhinc aliquot pervenerimus. Quae quidem pars ut est omnium pulcherrima atque utilissima, sic omnium longe difficillimam atque obscurissimam sententiarum interpretum tum Graecorum tum Latinorum, qui non pauci numero illam explanare conati sunt, varietas facile demonstrat, et ego sane experior, ut, quod omnium fere sermone celebratur, verissimum sit, nempe omnia pulchra esse difficilia. Verumtamen vel doctoris Papazonii planioris ac diligentioris interpretationis auxilio, vel commentarioli ab eodem in ipsos libros conscripti, mihique traditi, lumine, vel etiam crebra repetitione ac meditatione domestica omnes rei difficultates me superaturum esse confido.[19]

Il *commentariolus* sugli *Analitici secondi* consegnato da Papazzoni al Borromeo, potrebbe coincidere con l'attuale codice *G 81* del Fondo Sussidio della Biblioteca Ambrosiana di Milano, contenente una serie di scritti logici del filosofo bolognese, tra i quali anche una *Lectio in librum primum Posteriorum.*[20]

Purtroppo l'accertamento in merito a tale ipotesi si è rivelato impossibile a causa dei restauri tuttora in corso alla Ambrosiana. I lavori –protraentesi ormai da diversi anni– impediscono di fatto l'accesso a tutti i fondi ospitati dalla biblioteca. Sappiamo, però, che, oltre all'opera sugli *Analitici secondi* sopra menzionata, esistono all'Ambrosiana –annessi all'enorme patrimonio librario e documentario del fondatore della biblioteca, Federico Borromeo– alcuni altri manoscritti contenenti il testo di lezioni del Papazzoni. Del primo di essi conosciamo solo il titolo: *Pralectiones logicae exceptae sub Flaminio Papazzoni*, e, probabilmente, è la *reportatio* di un corso di logica tenuto dal maestro bolognese.[21] Un resoconto delle lezioni di filosofia del Papazzoni rimane invece in un codice di 143 fogli, che reca appunto il titolo *Praelectiones Philosophiae Flaminii Papazonii ad Federicum Comitem Borromeum*, e si apre (c. 2) con una *In Universam Philosophiam Praefatio*. Tra gli argomenti affrontati nello scritto doveva esserci anche l'esposizione della *Fisica*, poichè nell'ultima carta compare il *desinit*: «Finis Octavi Libri Physicorum».[22] Infine, sempre nel ricco fondo di manoscritti dell'Ambrosiana, si conserva un volume di 104 carte, contenente, tra le altre cose, un commento al *De anima* (c. 6: «In primum librum De Anima»). La stesura del testo fu completata –come risulta da ciò che si legge a c. 104v– a Pavia il 7 marzo 1583.[23]

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[19] Cfr. Marcora (cit. n. 16), 16-7; Sala (cit. n. 16), III, 699, che, però, ne pubblica solo uno stralcio.

[20] Secondo la descrizione fornita dal Marcora si tratterebbe di un manoscritto cartaceo di 21x15 cm., legato in pergamena, di 45 fogli. Alla c. 14 si leggerebbe: «Prolegomena in universam Philosophiam.» Mentre la c. 49, recherebbe l'indicazione: «Notatu digna ex lectione Flaminii Papazzonii». Cfr. Marcora (cit. n. 16), 17. Cfr. anche P. O. Kristeller, *Iter Italicum. A Finding List of Uncatalogued or Incompletely Catalogued Manuscripts of the Renaissance in the Italian and Other Libraries*, London/Leiden, 1963-1990, 6 voll., I, 346.

Quando quest'ultima opera fu conclusa, Papazzoni si trovava dunque già nella città lombarda, dove si era trasferito, al seguito di Federico Borromeo, nell'autunno del 1580. Secondo il Rivola fu lo stesso S. Carlo a chiedere al filosofo bolognese di raggiungere il giovane Federico a Pavia, presso il Collegio Borromeo, istituzione da lui medesimo fondata, e che allora muoveva i primi passi. Papazzoni rispose subito con entusiasmo all'istanza del Borromeo, e, dopo qualche tempo, il Cardinale Carlo: «in riconoscimento della pronta volontà di lui, lo fece dichiarar Lettor pubblico della città di Pavia con tutte quelle honoranze e preminenze che a tal uficio vanno congiunte.»[24] Dell'interessamento di Federico presso Carlo, al fine di procacciare una cattedra al Papazzoni, resta esplicita traccia nella lettera del giovane Borromeo al cugino del 27 settembre 1580, e nella relativa risposta del Cardinale.[25] La questione dovette risolversi in modo alquanto sollecito, poichè, già il 30 settembre –in una lettera a Guido Luca Ferrero, Cardinale di Vercelli– Federico scrive che

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[21] Bilioteca Ambrosiana, Milano, MS L. 66. Desumo l'informazione da *Federico Borromeo. Indice delle lettere a lui dirette conservate all'Ambrosiana*, Biblioteca Ambrosiana, Milano, 1960, 381. Ma cfr. anche Kristeller (cit. n. 20), I, 346.

[22] Biblioteca Ambrosiana, Milano, MS Sussidio B. 221. Poichè –come detto– è risultato impossibile accedere a questi documenti, la mia descrizione si basa interamente sui ragguagli del Marcora; cfr. Marcora (cit. n. 16), 17. Cfr. anche Kristeller (cit. n. 20), I, 346.

[23] Biblioteca Ambrosiana, Milano, MS Sussidio B. 222. Cfr. Marcora (cit. n. 16), 17; anche Kristeller (cit. n. 20), I, 346.

[24] F. Rivola (cit. n. 15), 38.

[25] Cfr. Marcora (cit. n. 16), 30-1.

Papazzoni «in hoc ticinensi gymnasio philosophiam publice profitebitur»,[26] mentre –il 20 novembre dello stesso anno– informa S. Carlo che: «bis quotidie Papazonium Phisica mihi privatim explicantem audio, *quae etiam, magno audentium concursu et approbatione, idem publice interpretatur*.»[27] Nondimeno, l'8 settembre 1581, Federico dettava una lettera (in volgare) in cui ancora una volta pregava il cugino cardinale di impegnarsi ad aiutare il Papazzoni: «cercando di ottenere o un intero luogo di ordinario della sera o honorare con buon aumento di salario questo luogo che hora ha della mattina.»[28] Nella sua replica, S. Carlo rassicurava Federico, comunicandogli di aver disposto: «che si faccia officio col S. Presidente et con chi altri sarà bisogno perchè il Dottor Papazzoni habbia il secondo luogo ordinario di filosofia»[29]

In quegli anni, l'attività del Papazzoni dovette dunque esplicarsi sul doppio binario delle pubbliche letture universitarie e degli impegni connessi alla funzione di precettore del giovane Borromeo. A fianco del futuro "Cardinal Federigo" caro al Manzoni (che –come è noto– ne tracciò un appassionato ritratto nel XXII capitolo dei *Promessi sposi*), il filosofo bolognese istituì pure un'accademia, quella degli *Accurati*, la cui impresa raffigurava una sfera tangente un piano perfettamente orizzontale, con le parole: *In puncto*. Secondo le informazioni trasmesseci dal Rivola: «Il luogo a questa Accademia destinato fu la sala maggiore del Collegio [Borromeo]: il dì prescritto, la giornata della vacanza: il principe di essa Federico: i reggitori e moderatori, Giovanni Botero, il Lettore Papazone, ed il P. Don Giovanni Bellarini...»[30] Una sorta di accademia, il Borromeo aveva già istituito durante i suoi brevi trascorsi bolognesi, congregando varie persone (tra cui lo stesso Papazzoni) allo scopo di esercitarsi nell'arte della disputa dialettica. I soci avevano l'abitudine di riunirsi la domenica, e mentre uno di loro, scelto a caso, sosteneva e difendeva una certa tesi, gli altri –secondo la prassi invalsa nelle *disputationes*–

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[26] Ibid., 32.

[27] Ibid., 33 (corsivo mio).

[28] Ibid., 41.

[29] Ibid.

[30] F. Rivola (cit. n. 15), 47. Sull'Accademia degli Accurati, cfr. anche M. Maylander, *Storia delle Accademie d'Italia*, Bologna, 1926-30, I, 50-2

dovevano argomentare in contrario.[31] Non possediamo ulteriori notizie sulle attività del Papazzoni nell'ambito delle istituzioni culturali promosse dal Borromeo. Nè ci rimangono altre testimonianze circa l'adesione papazzoniana al gruppo degli *Accurati*. Singolarmente, anzi, nell'unica occasione in cui il filosofo confessa una affiliazione accademica –e ciò avviene nell'intestazione di una poesia contenuta in un florilegio di liriche curata dal monaco e poeta bresciano Gregorio Ducchi– egli si qualifica come *Invaghito Academico Rinovato*.[32]

A quale tra le numerose *Accademie dei Rinnovati* –costituitesi, con diversa fortuna, un pò in tutta la penisola– Papazzoni appartenne, non sapremmo dire.[33] Allo stato attuale, i nostri riscontri in proposito si limitano alla traccia appena menzionata. Sulla base della posizione geografica e della circostanza motivante la raccolta del Ducchi (la morte di Eleonora d'Este) potrebbe, però, ipotizzarsi l'appartenenza del filosofo all'*Accademia dei Rinnovati* di Ferrara, sorta verso il 1579, e piuttosto attiva nell'ultimo scorcio del XVI secolo.[34]

Il soggiorno del Papazzoni a Pavia si protrasse fino al 1588, anno in cui egli ritornò a Bologna assumendo la cattedra di Filosofia della locale università. Purtroppo, a parte le menzionate lettere di Federico Borromeo, non conosciamo alcuna altra fonte in grado di fornirci indicazioni ulteriori sulla vita e l'attività del filosofo durante gli anni pavesi.[35] Dalla biografia del Borromeo scritta da Francesco Rivola, apprendiamo, comunque, che il Papazzoni fu tra coloro che, alla fine del settembre 1586, accompagnarono Federico all'atto del suo trasferimento da Milano a Roma, segno evidente che la frequentazione tra i due dovette proseguire anche dopo il conseguimento (maggio 1585) della laurea da parte del giovane conte.[36] In effetti, la partenza del Borromeo verso le glorie romane (sarà nominato cardinale il 18 dicembre 1587), pur segnando forse la definitiva separazione fisica tra il maestro bolognese e il suo mecenate, non ne interromperà mai il dibattito, che continuerà, attraverso un nutrito carteggio, fino quasi alla morte del Papazzoni.

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[31] Cfr. lettera di Federico a Carlo Borromeo del 18 novembre 1579, in Marcora (cit. n. 16), 14; anche Sala (cit. n. 16), III, 695-6. Cfr. inoltre F. Rivola (cit. n. 15), 28.

[32] Cfr. *Lagrime di diversi poeti volgari et latini. Sparse per la morte dell'Illustriss. et Eccellentissima Madama Leonora d'Este. Et raccolte da Gregorio Ducchi*, Vicenza, 1585, 25: «Dell'Eccellente Sig. Flaminio Papazzoni, L'Invaghito Academico Rinovato»; *incipit*: «Alma Real, che, rotto il terren panno / Poggiasti altera a' sacrosanti Cori;».

[33] Sono sorte –in vari periodi, invero– *Accademie dei Rinnovati* nelle seguenti città: Asolo, Castelnuovo, Cremona, Ferrara, Firenze, Massa-Carrara, Montenovo, Napoli, Palermo, Paternò, Roma, Tortona e Venezia. Cfr. M. Maylander (cit. n. 30), V, *sub voce*.

[34] Sull'*Accademia dei Rinnovati* di Ferrara, cfr. ibid., V, 462-3.

[35] E' tuttavia possibile che negli archivi della città lombarda (da me non esplorati) possano trovarsi documenti interessanti ai fini della ricostruzione della carriera e della personalità intellettuale del nostro autore.

Tra i documenti dello sterminato epistolario del Borromeo, conservato all'Ambrosiana, rimangono infatti ben 66 lettere del filosofo.[37] Purtroppo, come già notato in precedenza, la persistente, prolungata chiusura della biblioteca, non ha consentito uno spoglio di questa corrispondenza, sicuramente importante per la ricostruzione della biografia del nostro personaggio. Dalle date delle missive, emerge, in ogni caso, la durevolezza del legame che unì il Papazzoni al suo antico allievo: la prima lettera censita risale al 7 gennaio 1587 (da Pavia) mentre l'ultima è del 29 settembre 1612 (da Pratolino), e –fatta eccezione per il periodo 1603-1608– esiste almeno una lettera per ogni anno compreso tra l'inizio e la fine del carteggio. Il ricordo del Borromeo dovette dunque essere sempre presente alla mente del Papazzoni, anche se è probabile che la costanza nel rivolgersi all'ormai potente ex alunno fosse dettato –oltre che da motivi d'affetto e di stima– anche da ragioni d'interesse. Ancora a distanza di molti anni dalla sua esperienza di precettore del giovane nobile milanese, Papazzoni –secondo quanto racconta Giovanni Ciampoli, amico e corrispondente di Galileo– menerà vanto –esprimendosi, invero, in termini di fastidiosa millanteria–: «d'haver insegnato al Cardinal Bonromeo [sic] tutto quello che ei sa.»[38]

Dalla medesima lettera, emerge un quadro piuttosto inquietante della personalità e, soprattutto, del temperamento del professore bolognese. Narrando le lamentele papazzoniane nei propri confronti («dicendomi maravigliarsi che io havessi sparlato di lui»), Ciampoli delinea i tratti di un personaggio balzano, umorale, scostante e permaloso, capace di alternare scatti d'ira ad improvvise manifestazioni di cortesia e di affetto.[39] Nonostante l'asprezza del carattere e l'incostanza dell'umore, lo stesso Ciampoli dichiara, tuttavia, di stimarlo per «gran Peripatetico», anzi «per uno de' primi Peripatetici d'Italia».[40]

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[36] Il filosofo non raggiunse comunque la meta finale del viaggio, poichè –secondo quel che narra il Rivola– si fermò a Bologna. F. Rivola (cit. n. 15), 115.

[37] Cfr. *Federico Borromeo. Indice delle lettere* (cit. n. 21), 261.

[38] Da una lettera di Giovanni Ciampoli, senza data (ma del 1612) e senza destinatario; cfr. Galilei, *Opere* (cit. n. 1), XI, 454.30-1.

Dell'alta considerazione in cui il Papazzoni fu tenuto dai contemporanei rendono ulteriore notizia le parole di Cesare Pendasio –figlio di Federico– il quale, nel discorso tenuto in occasione del conseguimento del diploma dottorale, esalta le qualità del filosofo bolognese, ricordandone brevemente la carriera accademica e la stima di cui godette presso i due cardinali Borromeo, Carlo e Federico.[41] Lo stesso Giovanni Antonio Roffeni, attivo fautore della candidatura papazzoniana alla cattedra di Filosofia a Pisa, dichiarava di «restare talhora stupito amirando la profonda dottrina di esso, con nuove espositioni et nuova filosofia ancora.»[42] Un'altra attestazione di apprezzamento è, poi, certamente rappresentata dalla dedica al Papazzoni di due delle poesie commemorative pubblicate in morte del già menzionato Cesare Fantuzzi,[43] mentre anche molte delle fonti biografiche fanno riferimento alla reputazione di cui godeva come professore, menzionando l'iscrizione posta in suo ricordo dagli studenti dell'ateneo bolognese, nel 1599.[44]

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[39] Ciampoli parla di «furoretti alati che presto si quietano», di una «cortesissima escandescenza» e di una «rabbiuzza senile», tutte manifestazioni di un personaggio capace di stare a «mezzo tra lo sdegno e la cortesia». Ibid., XI, 454.35, 455.65, 454.34, 454.38.
Che la fama del Papazzoni (persino *post mortem*) non fosse delle migliori, lo attesta ancora la lettera di suor Maria Celeste Galilei al padre del 10 aprile 1628, in cui dichiara che: «La liberalità et amorevolezza di V. S. [Galileo] in alcuna maniera non compatisce di esser paragonata con l'avaritia del Papazzoni...» ibid., XIII, 411.2-3.

[40] Cfr. ibid., XI, 455.78, 453.10.

[41] Cfr. *Illustriss. et Excellent.^{mi} Domini Caesaris Pendasii Oratio*, in *Orationes habitae Bononiae in Doctoratu Illustriss. et Excellentiss. D. D. Caesaris Pendasii*, Bononiae, 1601, 11.
Cesare Pendasio, figlio di Federico, si laureò in Filosofia il 30 gennaio 1601. Nel 1604 ottenne la lettura bolognese di Logica. Nel 1607 passò ad insegnare Filosofia, tenendo la cattedra fino al 1628-9 (cfr. Alidosi [cit. n. 8], 45; Mazzetti, 1847 [cit. n. 8], 239). I suoi interessi dovevano essere prevalentemente di carattere medico. Lo si desume da alcune opere restanti: un ms. tra i codici Pinelliani della Bibl. Ambrosiana di Milano (MS. Q 122 sup.), recante il titolo *Caesaris Pendasii Quaestio de formatione foetus* (cc. 47r-59v), e un consiglio medico tra le carte del MS. 1293 del fondo Reginense latino della Bibl. Apostolica Vaticana. Per quest'ultima segnalazione cfr. Kristeller (cit. n. 20), II, 597.

[42] Lettera a Galileo dell'11 febbraio 1611; Galilei, *Opere* (cit. n. 1), XI, 45.10-1.

[43] Cfr. *Caesaris Elephantutii Viri nobilissimi Philosophiae et Medicinae doctrina suis temporibus celeberrimi Almi Artistarum Collegij Bononiensis Decani Funus*, Bononiae, 1607, 29, 33. Gli autori delle liriche erano rispettivamente Giulio Segni e Roberto Poggiolini. Su quest'ultimo non sono riuscito a trovare

E' presumibile che la fama del Papazzoni fosse legata proprio, in modo precipuo, alle sue qualità di insegnante, e forse, insieme, ad una erudizione che si esprimeva soprattutto nelle dispute orali. Il professore bolognese non sembra infatti aver lasciato alcuna opera a stampa, se si escludono le due –già più volte ricordate– orazioni in onore di Cesare Pendasio e in memoria di Cesare Fantuzzi.[45]

Alcuni suoi studi si conservano tuttavia manoscritti presso la Biblioteca Universitaria di Bologna. Poichè tali lavori offrono la possibilità di dare uno sguardo più ravvicinato all'attività intellettuale del nostro personaggio, procederemo a fornirne una breve descrizione. Il primo di tali scritti, è costituito da un codice di 161 fogli, recante la seguente dicitura: *Scripta Logicae Doctoris Papazzonii. Anno 1595 XVII Kalendas Novembris.*[46] L'opera –sostanzialmente divisa in due parti, la seconda delle quali porta la data del 1° maggio 1596 (*Bononiae, Calendis Maii 1596*)[47]– è intesa a fornire un agile compendio delle complicate questioni attinenti la logica aristotelica.

Papazzoni espone in modo stringato i concetti fondamentali relativi ad ogni argomento, avvalendosi spesso di schemi riassuntivi. Dopo aver specificato l'oggetto della Logica (cc. 2r-5r), definito il significato del termine, ed enunciato l'ordine degli argomenti da discutere (cc. 5r-7v), lo scritto procede -nella prima sezione- a svolgere tutto il contenuto delle *Categorie* (cc. 8r-41v), non senza dedicare alcuni rapidissimi accenni alla teoria del sillogismo (*De syllogismo*, cc. 17r-21r; *De reductione syllogismorum imperfectorum ad perfectos*, cc. 21r-22v). La seconda parte del volume è invece intesa a sviluppare i temi del *De interpretatione* (cc. 42r-76r), e a delineare la dottrina aristotelica della dimostrazione, attraverso una ordinata e sostanziosa trattazione degli *Analitici secondi*

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alcuna indicazione. Giulio Segni, professore di grammatica nello Studio bolognese, fu amico del Tasso, del quale curò l'edizione delle lettere (Bologna, 1616). Su di lui Cfr. Fantuzzi (cit. n. 8), VII, 378-81, IX, 185-7.

[44] Cfr. Alidosi (cit. n. 8), 70; Fantuzzi (cit. n. 8), VI, 278; A. Fabroni (cit. n. 1), II, 378.

[45] Cfr. Papazzoni 1601 (cit. n. 12) e Papazzoni 1607 (cit. n. 11).

[46] Biblioteca Universitaria, Bologna (BUB), MS 1175, c. 1r.

[47] Ibid., c. 42r.

(cc. 76r-159r).[48] Singolarmente, manca del tutto la discussione dei *Primi analitici,* per quanto, come detto, ai caposaldi della sillogistica Papazzoni avesse già avuto modo di fare sommario riferimento nel corso dell'esposizione dei *Praedicamenta.*

L'intento didascalico rende ragione di come il filosofo bolognese riesca a contenere in poco più di trecento pagine l'esposizione di quasi tutto l'*Organon* aristotelico, alla cui minuziosa esplicazione e commento erano solitamente destinati ponderosi volumi.[49] Le finalità didattiche, e le connesse esigenze di chiarificazione e divulgazione, vengono, del resto, esplicitamente dichiarate nella breve dedica agli *Studentissimis et florentissimis iuvenibus*, che apre la parte del compendio dedicata al *De interpretatione*:

> Non me latent –scrive Papazzoni, in un latino abbastanza contorto e non sempre inappuntabile– clarissimorum virorum lucubrationes, quae nobis, iuvenes lectissimi, possent aditum ad intelligendum hunc Aristotelis de interpretatione librum patefacere, in quo orationis enunciativae pars, species, affectionesque traduntur, enumerantur, ostenduntur; sed vitio mihi magis ac potius vertatur nimirum me pro vobis quos et doctrinae Peripateticae studiosos iuvare, et de me benemeritis obsequi concupisco elaborare, quam in eo quod requiristis operam meam desiderari, cum praecipue in hoc labore ordinis brevitate, interpretationis ordine, utriusque claritate sim, quatenus fieri poterit, moderaturus.[50]

Anche il secondo dei codici papazzoniani tuttora alla Biblioteca Universitaria di Bologna fu concepito –assai plausibilmente– per scopi attinenti all'insegnamento. Si tratta di una rubrica –recante il titolo *Terminorum ad Logicam attinentium brevis et dilucida interpretatio*– dove, in ordine alfabetico, vengono offerti chiarimenti sui concetti logici fondamentali.[51]

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[48] Molti anni dopo, nel 1612, Papazzoni, si riferirà agli *Analitici secondi* come ad una «materia tanto difficile *et nella quale io sono molto differente dalle communi espositioni*». Lettera a Galileo del 30 settembre 1612, in Galilei, *Opere* (cit. n. 1), XI, 405.17-8 (corsivo mio).

[49] Sull'ampia diffusione di volumi compendiari, atti a facilitare l'apprendimento della filosofia peripatetica durante il Rinascimento, cfr. le limpide note informative di C. B. Schmitt, *Aristotle and the Renaissance*, Cambridge (Mass.), 1983 [tr. it. di A. Gargano, Napoli, 1985], 88-98.

[50] BUB, MS 1175, c. 42r.

[51] BUB, MS 1072, cc. 19v-85r. Il codice –che consta di 96 fogli– contiene, oltre alla *Dilucida interpretatio* papazzoniana, anche alcuni stralci di diversa natura e provenienza. Così, le cc. 1r-9r, ospitano un abbozzo di dissertazione intitolato: *Fundamentum conclusionum circa Logicam* (*incipit*: «Logica non est scientia sive ars.»). L'argomento viene ripreso brevemente in una sorta di indice collocato alle cc. 87r-v del ms. Alla c. 10r, troviamo invece un breve riassunto dell'esperimento sul vuoto del monaco cappuccino Valeriano Magni (*incipit*:

In realtà, però, lo spettro dei termini esaminati è assai più esteso, includendo vocaboli propri della filosofia naturale e della metafisica, come anche termini non immediatamente "filosofici" (quali, per esempio, *Meatus*, *Beatitudo*, *Trigonus*). In tale ampio contesto, il nostro autore concentra la sua attenzione soprattutto nel fornire definizioni chiare e brevi, munite spesso del sussidio di schemi atti a facilitare la comprensione e l'assimilazione della complessa terminologia filosofica dell'aristotelismo.

In linea con una simile impostazione, appare anche l'ultimo degli inediti papazzoniani della Biblioteca Universitaria bolognese. L'opera aristotelica in oggetto è ora rappresentata dai *Meteorologica*, di cui Papazzoni offre un conciso riepilogo.[52] Nelle prime pagine dello scritto –datato 1599– il filosofo bolognese enuclea i temi salienti in discussione, inquadrandoli nell'ambito della filosofia naturale peripatetica. Viene fornito un prospetto della ripartizione delle tematiche nei vari libri costituenti il testo aristotelico, e, in generale, tutta l'esposizione –come si addice ad un compendio– fa un uso costante di definizioni e di schemi riassuntivi, destinati evidentemente a facilitare l'acquisizione delle nozioni fondamentali. Dalla trattazione è escluso il quarto libro dei *Meteorologica*, i cui argomenti sono –come ricorda lo stesso autore– svolti da Aristotele nell'ambito delle sue opere biologiche.[53]

L'attività scientifica del Papazzoni –quale emerge dai tre lavori appena considerati– si caratterizza, dunque, in modo evidente, come saldamente connessa all'impegno didattico: non voluminosi e prolissi

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«Experimentum Valeriani Magni Capucini demonstrans locum sine locato, seu Vacuum. Corpus motum successive in vacuo. Lumen nulli corpori inhaerens»). La questione degli esperimenti sul vuoto, viene ripresa in modo più articolato alle cc. 93r-96v. Poichè Papazzoni morì nel 1613, mentre Magni descrisse il suo esperimento in un libro –dal titolo quasi identico all'*incipit* sopra citato– pubblicato a Varsavia nel 1647, è evidente che le annotazioni in questione non sono attribuibili al nostro personaggio. E' invece possibile, che siano opera di Giovanni Girolamo Sbaraglia, un cui opuscolo di 40 cc., intitolato*Terminorum ad Philosophiam pertinentium Liber*, si conserva nella stessa cartella con il volumetto papazzoniano (al quale, del resto, assomiglia in modo notevole, tanto nel contenuto che nella forma espositiva). Su G. G. Sbaraglia (1641-1709), filosofo e medico dello Studio bolognese, protagonista di una accesa polemica col Malpighi, cfr. Fantuzzi (cit. n. 8), VII, 332-41.

[52] Cfr. *Compendium Librorum Meteororum Aristotelis Flaminii Papazonii Phil. Bon.*, BUB, ms. 9 H, cc. 207-23. Il ms. apparteneva alla collezione del già menzionato Girolamo Sbaraglia (cfr. *supra*, n. 51), come attestato dalla dicitura: «Ex Bibliotheca Io. Hyeronimi Sbaraleae». BUB, MS 9 H, c. 207r.

[53] Cfr. ibid., c. 223r.

commentari, carichi di erudizione e ricchi di dottrina, ma agili sunti, destinati a proporre –mediante sintesi ordinate e incisive– il nucleo essenziale delle tesi aristoteliche in modo chiaro e agevole da apprendere.

Che l'università fosse il mondo abituale di Papazzoni sembrano testimoniarlo anche le sue frequentazioni ed amicizie (almeno le poche di cui abbiamo notizia), tutte maturate nell'ambiente accademico. Abbiamo già ricordato il profondo legame che univa il nostro autore ai suoi maestri Cesare Fantuzzi e Federico Pendasio, la familiarità del suo rapporto col figlio di quest'ultimo, Cesare Pendasio (successivamente anch'egli insegnante presso lo Studio bolognese) e col collega Giovanni Antonio Roffeni. Della stretta consuetudine con altri due personaggi dell'ambiente intellettuale felsineo ci informa poi lo stesso filosofo, menzionando quali suoi intimi il teologo Tommaso Buldrini e il letterato Angelo Pagnoni.[54]

Nell'università di Bologna, del resto, Papazzoni trascorse molti, lunghi anni, anche dopo il suo ritorno dall'esperienza pavese al seguito del Borromeo. Egli tenne, infatti, la cattedra di Filosofia dell'ateneo emiliano interrottamente dal 1588 fino al 1610, con la sola eccezione dell'anno 1603-4, in cui passò temporaneamente ad insegnare Lettere umane.

Da una lettera di Giovanni Antonio Roffeni a Galileo del 18 giugno 1611, ricaviamo alcuni interessanti ragguagli circa il trattamento economico di cui il Papazzoni godeva presso lo Studio bolognese:

> mi disse –scrive il Roffeni– che in Bologna lui haveva trattenimento di scudi quattrocento, e ancora qualche cosa meglio, in letura, et il Collegio;[55] e che l'avantaggiarsi egli solamente li scudi 200, et uscendo fuori di casa, non poteva con questo stipendio mantenersi; oltre che non sarebbe suo decoro l'uscire fuori ad una cattedra, in età d'anni 60, nella quale ha quanto mai può circa la fama,

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[54] Cfr. Papazzoni 1607 (cit. n. 11), 41. Tommaso Buldrini, sacerdote e teologo, fu arciprete della chiesa di Minerbio, e compositore di orazioni funebri. Cfr. Alidosi (cit. n. 8), 178; A. Bumaldi (cit. n. 8), 118; Fantuzzi (cit. n. 8), II, 369; G. M. Mazzucchelli, *Gli scrittori d'Italia*, Brescia, 1753-63, II, 1457. Angelo Pagnoni fu Maestro pubblico di Lettere umane a Bologna. Non riuscì tuttavia mai ad ottenere una cattedra ad entrare così stabilmente nei ruoli dell'università. Morì nel 1589, lasciando un commentario alle satire di Orazio, stampato postumo nel 1591. Cfr. Fantuzzi (cit. n. 8), VI, 219-20, IX, 165.
Sicuramente, Papazzoni fu in contatto anche col Card. Paleotti. Nell'archivio Isolani (sezione dell'archivio Paleotti) a Bologna, esistono due lettere del Cardinale al filosofo (rispettivamente: MS F.5.74.14; MS E.51.47). Cfr. Kristeller (cit. n. 20), V, 502, 508. Il Mittarelli segnala inoltre lettere di Giulio Castellani al Papazzoni; cfr. G. B. Mittarelli, *De Literatura Faventinorum. Sive de Viris et Scriptoribus Urbis Faventiae*, Venetiis, 1775, col. 44.

[55] Il riferimento è ai proventi di cui, come membro del Collegio di Medicina e Arti, il Papazzoni poteva usufruire in occasione delle lauree.

> havendo letto in Pavia, et tanti anni l'ordinario di filosofia in questo Studio, con stipendio delli 600 scudi.[56]

Le informazioni fornite dal Roffeni, si inserivano nel quadro delle complesse trattative destinate a portare il Papazzoni alla cattedra di Filosofia dell'università pisana, di cui abbiamo già fatto cenno, menzionando l'istanza del Vinta e la risposta di Galileo.[57] E' evidente che –tramite il Roffeni– il maestro bolognese mirava ad ottenere condizioni economiche più vantaggiose di quelle offertegli nella sua città natale.

Quale fosse lo stipendio percepito dal Papazzoni a Pisa, lo apprendiamo da una scrittura notarile –redatta in Bologna il 19 luglio 1611– destinata, di fatto, a sancire la conclusione dei lunghi negoziati (si iniziarono nel gennaio di quell'anno) in merito all'assegnazione della prima cattedra ordinaria di Filosofia dello Studio pisano. Con quel documento, Papazzoni nominava Galileo («absentem sed tamquam praesentem») suo «verum, certum, legitimum et indubitatum procuratorem», conferendogli ampia facoltà di rappresentarlo per tutti gli atti che si fossero resi necessari: «ad conficiendum et stipulandum instrumentum conductionis ad primam cattedram philosophiae ordinariae in Almo Studio Pisarum [...], per annos quatuor, cum annuo salario scutorum octigentorum valoris librarum septem pro quolibet scuto monetae Florentiae»[58]

La procura bolognese veniva dunque a porre il suggello definitivo alla complessa manovra volta a condurre il Papazzoni a Pisa. In tutta la vicenda –è bene ricordarlo– Galileo svolse un ruolo fondamentale, talchè può dirsi che fu grazie proprio al suo favore e alla sua fattiva collaborazione se l'aristotelico felsineo conseguì la sospirata lettura.[59]

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[56] Galilei, *Opere* (cit. n. 1), XI, 128.8-14.

[57] Cfr. *supra*, 1-2. Il Vinta chiederà ancora notizie del Papazzoni nella lettera a Galileo del 20 gennaio 1611, annunciando la candidatura di altri filosofi alla cattedra pisana, tra cui quella del padovano Camillo Belloni. Cfr. Galilei, *Opere* (cit. n. 1), XI, 28. Costui era stato fortemente raccomandato a Galileo da Paolo Gualdo (cfr. ibid., X, 498, XI, 42, 44,56, 100, 117, 157), e dal fratello Giovanni Belloni (cfr. ibid., XI, 64-5).

[58] Ibid., XIX, 270.18-22. A questa cifra (800 scudi), Papazzoni aggiungeva ancora un *viatico* di 150 scudi «pro una vice tantum», come prescritto dagli Statuti dell'università pisana. Cfr. ibid., XIX, 270.22-4.

[59] Oltre alla sopracitata procura, lo attesta in modo irrefutabile anche tutto il carteggio relativo alla questione, sia nella parte attinente alla candidatura del Belloni (cfr. *supra*, n. 57), sia nella documentazione concernente la mediazione del Roffeni (cfr. *infra*, n. 60). A ciò si aggiungano le lettere del Papazzoni

Accanto all'azione dello scienziato, preziosa per il buon esito del *negotio* fu sicuramente la solerte attività di mediazione e patrocinio svolta da Giovanni Antonio Roffeni, il quale, peraltro –a giochi ormai fatti– esprimerà disappunto per la partenza dell'amico, confessandosi un po' pentito di aver tanto operato per propiziarla.[60]

Del breve soggiorno del Papazzoni a Pisa abbiamo scarse notizie. Sappiamo che l'11 ottobre 1611, si tratteneva ancora a Bologna, apprestandosi tuttavia a raggiungere al più presto la nuova sede universitaria per prendervi servizio ed iniziare così il primo anno di insegnamento.[61]

Nella città toscana, Papazzoni era sicuramente per il Natale, come testimonia una lettera a Federico Borromeo del 25 dicembre 1611.[62] Ai primi dell'estate dell'anno successivo lo ritroviamo a Bologna, dove consegna ad Antonio Magini una copia del galileiano *Discorso intorno alle cose che stanno in su l'acqua o che in quella si muovono*,[63] ma, nel luglio, si era già trasferito presso la villa medicea di Pratolino, per tenere lezioni sugli *Analitici posteriori* a Carlo de' Medici.[64]

Le ultime tracce del nostro personaggio, lo vogliono nuovamente a Pisa, nell'aprile del 1613 –quando scrive a Galileo per ringraziarlo dell'invio di un volume (forse il libro sulle macchie solari)– e, poi, ancora,

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medesimo, dalle quali si evince chiaramente come Galileo fosse l'interlocutore principale di tutta la vicenda. Cfr. Galilei, *Opere* (cit. n. 1), XI, 59, 63.

[60] «Sono stato uno pezo con il S.re Papazzone –scrive a Galileo, l'11 ottobre 1611– che a punto gli scriveva della partita che debbe fare, et il quando, sì che la povera città perde quanto haveva di buono, e tanto me ne duole, che non voglio vederlo partire al sicuro: et se il negotio si commintiasse di nuovo a trattare, mi credi che mi sforzerei di disturbarlo. Ma non è più tempo: *utinam dulcis patria eius habeat illius ossa*. In questo ultimo di vitta sua, gli aggrava quanto a me –soggiungeva il Roffeni– di abandonare le proprie comoditati. Allo comparire, legerà il soprascritto, e ne farà il iuditio. *Et de his hactenus.*» Ibid., XI, 217.7-14. Per i riscontri circa l'attiva opera svolta dal Roffeni a sostegno delle aspirazioni papazzoniane alla cattedra pisana, cfr. ibid., XI, 44-5, 58-9, 66, 128-9, 138, 207.

[61] Cfr. ibid., XI, 217.

[62] Cfr. *Federico Borromeo. Indice delle lettere* (cit. n. 21), 261.

[63] Cfr. lettera del Magini a Galileo del 23 giugno 1612, Galilei, *Opere* (cit. n. 1), XI, 339.

[64] Esistono all'Ambrosiana tre lettere del Papazzoni a F. Borromeo da Pratolino, scritte rispettivamente il 18 luglio, l'8 agosto e il 29 settembre. Cfr. *Federico Borromeo. Indice delle lettere*, (cit. n. 21), 261. Dell'insegnamento privato a Carlo de' Medici, rende notizia lo stesso Papazzoni nella lettera a Galileo del 30 settembre 1612. Cfr. Galilei, *Opere* (cit. n. 1), XI, 405-6.

nel novembre, come testimoniato da una lettera del Castelli.[65] Il primo giorno di gennaio del 1614, infine, Giovanni Antonio Magini informa, da Bologna, Galileo, dell'avvenuta morte del filosofo, soggiungendo che: «me n'è incresciuto grandemente, sì come a tutta la città.»[66]

Gli aspetti più interessanti dei trascorsi pisani del Papazzoni concernono la sua partecipazione alla disputa su questioni idrostatiche, che oppose Galileo ad un gruppo di filosofi aristotelici (Giorgio Coresio, Ludovico Delle Colombe, Vincenzo Di Grazia). La polemica –originatasi da una serie di riunioni avvenute nell'estate del 1611– si protrasse per vari anni, e può dirsi conclusa solo nel 1615. Come è noto, fu proprio nell'ambito di questa controversia che Galileo diede alle stampe il suo *Discorso intorno alle cose che stanno in su l'acqua o che in quella si muovono*, impegnandosi poi, insieme col fido discepolo Benedetto Castelli, in una minuziosa opera di confutazione degli argomenti addotti dai peripatetici.[67]

Papazzoni prese sicuramente parte all'acceso dibattito, difendendo –alla presenza di Cosimo II– le tesi aristoteliche sul ruolo della figura nel galleggiamento dei corpi dalle obiezioni sollevate in proposito da

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[65] Cfr. ibid., XI, 496, 590.18.

[66] Ibid., XII, 11.5-6. Stranamente, tutte le fonti biografiche (cfr. Alidosi [cit. n. 8], 69; Fantuzzi [cit. n. 8], 279; Mazzetti, 1847 [cit. n. 8], 108) sostengono che Papazzoni spirò a Pisa, nel gennaio del 1614. Ora, poichè la notizia del decesso viene comunicata (dal Magini) fin dal 1° gennaio, appare ovvio –e tanto più se si prende per buono che il fatto sia avvenuto in terra toscana– che la morte debba risalire alla fine dell'anno precedente, cioè negli ultimi giorni del dicembre 1613.

[67] Cfr. *Discorso intorno alle cose che stanno in su l'acqua o che in quella si muovono*, in: Galilei, *Opere* (cit. n. 1), IV, 57-141; *Risposta alle opposizioni di L. delle Colombe e di V. Di Grazia contro al trattato delle cose che stanno su l'acqua o che in quella si muovono*, ibid., IV, 449-789. Ma vedi, in generale, tutto il ponderoso quarto vol. delle Galilei, *Opere* (cit. n. 1), che riporta anche le scritture degli avversari di Galileo.
Eccellenti ricostruzioni della disputa sono state fornite da Stillman Drake, William Shea e Paolo Galluzzi. Cfr. S. Drake, *Galileo Studies*, Ann Arbor, 1970, 159-76; W. R. Shea, "Galileo's Discourse on Floating Bodies: Archimedean and Aristotelian Elements," in: *Actes du XII Congrès International d'Histoire des Sciences*, Paris 1971, IV, 149-53; idem, *Galileo's Intellectual Revolution*, London/ Basingstoke, 1972 [tr. it. di P. Galluzzi, Firenze, 1974], 30-70; P. Galluzzi, *Momento. Studi galileiani*, Roma, 1979, 227-46. Stillman Drake ha anche dato vita ad un interessante tentativo, fondendo –nell'ambito di un dialogo che imita i capolavori galileiani– la traduzione del *Discorso intorno alle cose che stanno in su l'acqua*, con brani di sua composizione. Cfr. S. Drake, *Cause, Experiment and Science. A Galilean dialogue incorporating a new English translation of Galileo's "Bodies That Stay atop Water or Move in It"*, Chicago and London, 1981.

Galileo.[68] E' tuttavia difficile stabilire con precisione quando i due personaggi discussero di fronte al Granduca dei problemi idrostatici. Stillman Drake, che ha dedicato una meticolosa ricostruzione allo sviluppo degli eventi in questione, parla di diversi incontri («several [...] debates at the ducal table»), avvenuti dopo l'arrivo del bolognese a Firenze, alla metà del settembre 1611.[69] In realtà, non ci sono prove per affermare che i dibattiti furono molteplici e non uno solo, mentre appare egualmente problematico sostenere la presenza del Papazzoni a Firenze nel settembre 1611, e collocare, dunque, la contesa (o le varie discussioni) in quel torno di tempo. Sappiamo, infatti, che l'11 settembre il filosofo era certamente a Bologna, dove pure si trovava il 3 di ottobre, giorno in cui scrisse al suo vecchio allievo, il Cardinale Borromeo.[70] Quest'ultimo riscontro rende piuttosto dubbia l'eventualità di una partecipazione del professore bolognese al pranzo offerto dal Granduca in onore dei cardinali Ferdinando Gonzaga e Maffeo Barberini –tra il 31 settembre e il 3 ottobre– circostanza in cui, invece –secondo Drake: «Cosimo invited Galileo and Papazzoni to repeat their arguments before the two distinguished visitors.»[71] E' pertanto probabile che la discussione (o le discussioni) tra lo scienziato e il suo interlocutore felsineo, abbia avuto luogo in un periodo successivo.

Sempre a giudizio di Drake, Flaminio Papazzoni sarebbe il vero autore delle *Considerazioni sopra il discorso del Sig. Galileo Galilei intorno alle cose che stanno in su l'acqua o che in quella si muovono* [...] *fatte a dichiarazione dell'opinione d'Aristotile da Accademico Incognito,* un volumetto, stampato a Pisa nel luglio del 1612, che rappresenta la prima risposta di parte aristotelica al *Discorso* idrostatico di Galileo.[72]

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[68] Cfr. Galilei, *Opere* (cit. n. 1), IV, 329.28, 515.26, 517.13-4, 537.35, 538.22; XI, 453.5-8.

[69] Cfr. S. Drake, *Galileo Studies* (cit. n. 67), 161. Secondo Drake, fu Galileo stesso a sollecitare la venuta del Papazzoni a Firenze e la sua partecipazione alla disputa, allo scopo di rafforzare agli occhi della corte il prestigio legato al titolo di Primario Matematico e Filosofo del Granduca. Cfr. ibid. Questa asserzione appare, invero, scarsamente giustificabile sulla base della documentazione esistente, poichè in nessun luogo, nè del carteggio nè delle opere, emergono riscontri in tal senso.

[70] Cfr. rispettivamente: Galilei, *Opere* (cit. n. 1), XI, 207, e *Federico Borromeo. Indice delle lettere* (cit. n. 21), 261.

[71] S. Drake, *Galileo Studies* (cit. n. 67), 162. Anche idem, *Galileo at Work. His Scientific Biography*, Chicago/London, 1978, 174. Secondo Drake il pranzo si tenne il 2 ottobre 1611.

Dietro lo pseudonimo di *Accademico Incognito,* i primi biografi galileiani credettero di poter riconoscere la figura di Tommaso Palmerini, un letterato pisano di scarsa notorietà.[73] Fu Antonio Favaro, alla fine del secolo scorso, a smentire, sulla base di riscontri inoppugnabili, una simile identificazione, e a suggerire che sotto la maschera dell'*incognito* oppositore di Galileo si celasse, in realtà, il volto di Arturo Pannocchieschi de' conti d'Elci, provveditore dell'ateneo pisano, e autore della dedicatoria premessa alle *Considerazioni.* Nella sue breve prefazione, peraltro, l'Elci dichiarava di essere semplicemente il traduttore dell'opera.[74] Il Favaro suffragava, in seguito, la sua identificazione mediante il ritrovamento di una lettera dell'Elci a Federico Borromeo (in data 27 agosto 1612), con la quale il senese accompagnava l'invio di «certe brevi Considerazioni fatte sopra 'l discorso del S.$^{\text{or}}$ Galileo Galilei», di cui si diceva autore.[75]

In merito alla ricostruzione favariana, Stilman Drake ha sollevato delle interessanti obiezioni. A suo giudizio, risulta, in primo luogo, incongrua la circostanza che l'Elci voglia mascherare la sua identità dietro uno pseudonimo e, al contempo, firmi la dedica del volume. Tanto più, soggiunge lo studioso americano, che lo stesso Elci invia copia dell'opera al Borromeo, di cui era nota la dimestichezza con Galileo. In secondo luogo, secondo Drake, il provveditore pisano non aveva alcuna ragione per nascondersi, dal momento che la replica dell'Accademico Incognito è certo la più mite e stimabile («creditable») tra le risposte degli oppositori galileiani, e non poteva certo sollevare severe rappresaglie da parte dello scienziato. Infine, bisogna ancora ricordare che Elci non era un filosofo, e, dunque, presumibilmente, non disponeva di una salda competenza in materia, mentre scrivere una risposta al *Discorso* galileiano in poche settimane avrebbe senza dubbio richiesto «intimate familiarity with the subject». Tutti questi elementi –che lo storico americano qualifica come «cogent arguments [...] from internal evidence»– considerati nell'insieme, portano Drake ad escludere che Arturo Pannocchieschi Elci possa credibilmente esser ritenuto l'autore delle *Considerazioni*.[76]

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[72] Cfr. Galilei, *Opere* (cit. n. 1), IV, 143-182.

[73] Per la disamina delle fonti in tal senso, cfr. A. Favaro, "Alcuni scritti inediti di Galileo Galilei tratti dai manoscritti della biblioteca nazionale di Firenze," in: *Bullettino di bibliografia e di storia delle scienze matematiche e fisiche*, 16 (1883), 166-73.

[74] Ibid., 173-8. Il nobile senese Arturo Pannocchieschi d'Elci (1564-1614), studiò e si addottorò a Siena, passando poi a Roma. Nel 1609 fu chiamato a ricoprire l'incarico di provveditore dell'università pisana. Morì il 20 settembre 1614. Per la bibliografia sull'Elci cfr. *infra*, n. 86.

[75] Cfr. A. Favaro, "Conchiusioni sull'Accademico Incognito oppositore al discorso di Galileo intorno alle cose che stanno in su l'acqua o che in quella si muovono," in: *Bullettino di bibliografia e di storia delle scienze matematiche e fisiche* 18 (1885), 321-6. Per la lettera dell'Elci cfr. anche Galilei, *Opere* (cit. n. 1), XI, 384.

Di contro, sempre secondo Stillman Drake, esistono sicuri indizi a favore della ipotesi che a redigere l'operetta antigalileiana fosse Flaminio Papazzoni, il quale –a differenza dell'Elci– era un filosofo di professione e doveva quindi padroneggiare assai bene la questione in discussione. Il bolognese aveva, poi, un'ottima ragione per dissimulare la sua identità, in virtù del debito di riconoscenza contratto nei confronti di Galileo, quale fautore della sua nomina a Pisa. Al tempo stesso, però, egli si sentiva anche obbligato a scendere in campo: dopo aver difeso Aristotele di fronte al Granduca, infatti, non poteva mancare di rintuzzare le controargomentazioni galileiane, poichè: «the ordinary rules of conduct in such disputes would require him to reply».[77] Infine, occorre notare che l'Accademico Incognito parla come se fosse estraneo alla controversia, non annoverando sè stesso tra gli avversari dichiarati di Galileo; ciò si accorda perfettamente con la posizione di Papazzoni che mirava solo a difendere Aristotele, senza militare nella squadra degli antigalileiani più oltranzisti.[78]

Quanto, poi, alla lettera dell'Elci al Borromeo –la quale sembra confortare in modo assai probante il riconoscimento effettuato dal Favaro– essa, a giudizio di Drake, accompagnava non il libro dell'Accademico, ma uno scritto (che non verrà mai stampato) del provveditore pisano, redatto, molto probabilmente, dopo che questi aveva tradotto il libro del Papazzoni, vero *Accademico Incognito*.[79] La ricostruzione di Stillman Drake deve essere apparsa oltremodo persuasiva, se il catalogo dei libri italiani del XVII secolo ospitati nella British Library può registrare, senza ulteriori delucidazioni, le *Considerazioni di*

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[76] Cfr. S. Drake, *Galileo Studies* (cit. n. 67), 171.

[77] Ibid.

[78] Cfr. ibid., 172.

[79] Cfr. ibid., 172-3.

Accademico Incognito come opera di Flaminio Papazzoni.[80] Identica opinione era, del resto, già stata espressa da un contemporaneo di Galileo, l'ecclesiastico Giovanni Battista Agucchi, attivo corrispondente dello scienziato pisano. Dopo aver scorso il volume, Agucchi dicharava di essersi persuaso che, «per la maniera del trattare», «l'autore sia facilmente il Papazzoni, condotto, non è molto, a leggere a Pisa, il quale è veramente riputato gran Peripatetico...»[81]

Giovanni Battista Agucchi era bolognese come Papazzoni, e doveva dunque avere una certa qual conoscenza del nostro personaggio. Nondimeno, la sua conclusione, così come quella di Drake, appare in assoluto non convincente, per ragioni che proveremo ad esporre in ciò che segue.

Cominciamo dalle circostanze che renderebbero implausibile l'identificazione –sostenuta dal Favaro– dell'Accademico Incognito con la persona di Arturo Pannocchieschi d'Elci. Drake, come detto, rileva che Elci non avrebbe avuto alcun motivo di celare la sua identità, e, qualora avesse voluto realmente nascondersi, sarebbe stato inopportuno firmare la dedica del libro e inviarne una copia al Borromeo, di cui era nota la stima nei confronti di Galileo.

Ora, nel proporre un simile argomento, lo studioso americano sembra sottovalutare il fatto che ad Arturo d'Elci, nella sua veste di provveditore dell'ateneo pisano, non sarebbe certo stato possibile esporsi pubblicamente, in modo clamoroso, contro un personaggio (Galileo), il quale, non solo faceva parte dei ruoli dell'istituzione da lui diretta, ma era, al tempo stesso, alle dirette dipendenze di Cosimo II, come *Primario Matematico e Filosofo* della persona del Granduca.

In effetti, per valutare in modo adeguato la situazione in cui venne a trovarsi l'Elci, occorre tenere presente la forte connotazione socio-professionale che contraddistinse la disputa idrostatica. La controversia vide, infatti, protagonisti, da una parte, un gruppo di rappresentanti del tradizionale *establishment* culturale toscano, con uno *status* ed una fisionomia sociali ed istituzionali ben definiti e consolidati, e dall'altra un *outsider* (Galileo), al culmine del successo, e, perciò, assolutamente inviso agli esponenti della prima fazione, i quali ne detestavano e temevano il crescente influsso presso la corte, ne odiavano la carica innovatrice delle idee, e, aspetto non trascurabile, ne invidiavano il cospicuo stipendio.[82] Oltre a ciò, il sovvertimento delle competenze e della gerarchia accademica –per cui un matematico si prendeva l'arbitrio di rimbeccare Aristotele, invadendo un terreno da sempre strettamente riservato alla "casta" dei filosofi– contribuì ulteriormente ad innescare la vivace reazione dei professori aristotelici, e finì per suscitare, verosimilmente, anche l'ostilità dei quadri dirigenti dell'ateneo.[83]

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[80] Cfr. *Catalogue of the Seventeenth Century Italian Books in the British Library*, London, 1986 (^{2}1988), II, 656.

[81] Galilei, *Opere* (cit. n. 1), XI, 390.15-21.

Se questo spiega il probabile malanimo dell'Elci –il quale, del resto, sappiamo, non gradiva le innovazioni in ambito accademico–[84] dobbiamo nondimeno considerare che, pure, egli, nella sua qualità di pubblico funzionario, non avrebbe potuto –soprattutto per non screditarsi agli occhi del Granduca– attaccare direttamente ed in modo esplicito un docente dell'università a cui era preposto. Il provveditore, quindi, proprio in virtù della carica che ricopriva, aveva –contrariamente a quel che sostiene Drake– delle validissime ragioni per dissimulare la sua vera identità, assumendone una fittizia. D'altro canto, è lecito presumere che l'Elci fosse nel contempo interessato a segnalare la propria sollecitudine nei confronti delle vicende che animavano il dibattito culturale pisano (e la controversia idrostatica fu sicuramente tra queste). Da ciò, quindi, la decisione di firmare la dedica dell'operetta.

Quanto al fatto che Arturo Pannocchieschi d'Elci abbia mandato una copia delle *Considerazioni* a Federico Borromeo –gesto che Drake giudica "sciocco" («foolish») se compiuto dal vero Accademico Incognito– in realtà, come vedremo, esso si giustifica pienamente sulla base di un misconosciuto riscontro biografico relativo alla figura del provveditore pisano. Per discutere adeguatamente la questione, ma anche per intendere appieno la straordinaria incidenza probatoria del documento scoperto dal Favaro, consideriamo la già menzionata lettera dell'Elci (da Firenze) al Borromeo del 27 agosto 1612:

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[82] Quest'ultimo elemento è ben evidenziato da Castelli nella lettera a Galileo del 20 novembre 1613: «il Sig.^{r} Dottor Ruschio anotomista [...] mi soggionse a lettere di scattole che V. S. non era invidiata da etc. per le grandi e meravigliose doti del suo intelletto, come quelle che non cascano sotto la cognizione nè considerazione de' maligni, *ma per quelli mille scudi, conosciuti forsi più da loro ed avidamente bramati, che da V. S.*» Ibid., XI, 596.7-12 (corsivo mio).

[83] Cfr. M. Biagioli, "The Anthropology of Incommensurability," in: *Studies in History and Philosophy of Science* 21 (1990), 183-209 ; M. Biagioli, *Galileo, Courtier. The Practice of Science in the Culture of Absolutism*, Chicago, 1993, 159-209, 227-32.

[84] Nel novembre del 1613, ad esempio, inviterà esplicitamente Castelli –appena nominato professore a Pisa– a non trattare *ex cathedra* la questione del moto della terra. Cfr. Galilei, *Opere* (cit. n. 1), XI, 589-90.

> Essendomi trattenuto quest'anno in Pisa, –scrive il nobile senese– quasi tutto Agosto, presi a fare certe brevi Considerationi sopra il Discorso del S.^{or} Galileo Galilei, solo per mio trattenimento e per esercitio di stile, e per prova se una volta io mi potessi mettere a scrivere alcuna cosa più grave. So certo, non esser degne di comparire inanzi al cospetto di V. S. Ill.^{ma}, non che d'esser proposte all'ottimo et isquisito giuditio di lei. Nondimeno l'affetto dell'antica mia servitù verso V. S. Ill.^{ma} mi muove a prendere occasione, ancora dalle cose minime, di farle riverenza, come desidero e son in speranza di potere fare personalmente tra breve tempo.[85]

Come si vede, il testo sembra confermare in modo perentorio –soprattutto attraverso il titolo («Considerationi sopra il Discorso») singolarmente collimante con quello scelto dall'Accademico Incognito– la ricostruzione favariana. Inoltre, in contrasto con quanto asserito da Drake, la lettera ci segnala anche il motivo che spinse Arturo Pannocchieschi d'Elci ad inviare il volume al Borromeo: il provveditore scrive, infatti, di esser stato mosso da «l'affetto della [...] antica servitù» che lo legava al cardinale. Quest'ultimo dettaglio è comprensibile solo alla luce di una circostanza stranamente ignorata da tutte le fonti biografiche,[86] le quali mai menzionano il servizio prestato dal nobile senese come segretario di Federico Borromeo.[87] Sulla base delle appena accennate evidenze, è possibile affermare che sussistono riscontri abbastanza consistenti a sostegno della conclusione del Favaro, secondo cui *Accademico Incognito* rappresentava lo pseudonimo scelto da Arturo d'Elci per intervenire nella controversia insorta tra Galileo e gli aristotelici toscani nell'estate del 1611.

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[85] Ibid., XI, 384. Cfr. anche A. Favaro (cit. n. 75), 325.

[86] Per notizie sull'Elci cfr. I. Ugurgieri Azzolini, *Le Pompe sanesi. Ovvero Relazione delli huomini e delle donne illustri di Siena e suo Stato*, Pistoia, 1649, 591-2; A. Fabroni, *Historia* (cit. n. 1), II, 36-7; G. Cinelli Calvoli, *La Toscana Letterata ovvero Istoria degli Scrittori Toscani*, Biblioteca Nazionale di Firenze, Ms. Magl. IX, 68, 198-9; A. M. Biscioni, *Giunte alla Toscana Letterata del Cinelli*, Bibl. Naz. di Firenze, Ms. Magl. IX.80, XII, 309; L. de Angelis, *Biografia degli scrittori sanesi*, Siena, 1824, 276-8; G. Gigli, *Diario sanese*, Siena, 1854, I, 392.

[87] La permanenza dell'Elci presso il Borromeo, è attestata dall'epistolario del Cardinale, in cui si conservano numerose missive spedite al senese da parenti, oltre a tredici lettere da lui stesso inviate, in tempi diversi, a Federico Borromeo. Il catalogo della corrispondenza presenta, appunto, Arturo Elci come segretario del Borromeo. Dai riscontri relativi alle date dei vari documenti del carteggio, può desumersi che il suo servizio si sia svolto nel torno di tempo tra il 1594 e il 1598. Cfr. *Federico Borromeo. Indice delle lettere* (cit. n. 21), 142-3. Singolarmente, nessuna delle *Vite* di F. Borromeo da noi consultate, riporta mai il nome di Arturo Pannocchieschi d'Elci.

In tal senso, l'indicazione più probante a favore della coincidenza tra la figura del provveditore pisano e l'anonimo *Accademico*,[88] autore delle *Considerazioni*, si desume proprio da alcuni passi del testo dell'operetta in questione. Ivi, dopo aver messo in dubbio e discusso la correttezza logica e la congruenza di un ragionamento galileiano, si legge:

> Ma finiamo ormai di più tanto puntualmente loicare e filosofare; nelle quali arti, come che molti anni io impiegassi della mia giovinezza e sempre dilettato mi sia de' loro nobili studi, poco però n'appresi; e già gran tempo da altre cure ritenuto, Iddio voglia che almeno de' lor primi elementi io sappia o possa pure ricordarmi:...[89]

La dichiarazione è esplicita, e attesta che –a differenza di ciò che sostiene Drake– chi scrisse le *Considerazioni* non era (per sua stessa ammissione) un filosofo. Costituirebbe, invero, circostanza oltremodo singolare che un professore universitario di filosofia –quale Papazzoni– dichiari di aver imparato così poca logica, da pregar Dio di poterne ricordare almeno i rudimenti. E' evidente dunque che colui il quale pose mano alla prima delle risposte aristoteliche al *Discorso* galileiano, non si occupava di filosofia per professione, essendo –come egli stesso confessa– «da altre cure ritenuto».

Di ciò, del resto, troviamo ulteriore, significativa riprova al termine delle *Considerazioni*, quando l'Accademico Incognito scrive:

> Però, rimettendo il tutto al giudizio de gli intendenti, porrò fine di più il tempo spendere in sì fatte materie, *poichè troppo sono oggi lontane dalla mia professione e dalle mie occupazioni.*[90]

Nessun docente di filosofia avrebbe mai sostenuto che le propensioni dinamiche e la densità degli elementi, la natura del grave e del leggero, l'effettiva esistenza di una leggerezza positiva, il ruolo della figura nel moto *sursum* e *deorsum* e nel galleggiamento, la difesa delle critiche aristoteliche all'atomismo democriteo (per citare solo alcuni del temi sviluppati nell'opera dell'Accademico Incognito) fossero argomenti esulanti dalla sfera della propria attività professionale. Nè avrebbe mai confessato di dover lasciare tali dibattiti –come questioni troppo lontane dalle proprie occupazioni– al giudizio degli esperti. Semplicemente, dunque, l'autore delle *Considerazioni* attendeva per mestiere ad altro che non alla filosofia.

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[88] Vale la pena di ricordare che l'Elci faceva parte della senese *Accademia dei Filomati.*

[89] Galilei, *Opere* (cit. n. 1), IV, 177.3-7.

[90] Ibid., IV, 181.35-7 (corsivo mio). Anche nella premessa dell'opera (*L'Autore delle Considerazioni alle medesime*) compare una simile affermazione: «...e più spedito alle mie debite occupazioni ritorno» Ibid., IV, 152.14.

Il suo intervento nell'ambito della disputa si qualifica, del resto, come motivato dalla preoccupazione che, qualora «molti giovani, d'ingegno vivace e curiosi di sapere molte cose» rimangano «allettati dalla novità della dottrina» (galileiana), deviando così «incautamente dalla strada piana e sicura della filosofia peripatetica», «troppo perderebbono di frequenza gli Studi e le scuole pubbliche, e poco sarebbono ascoltati i grand'insegnatori che hanno Aristotile per guida e per primo maestro.»[91] Scrupoli, non è difficile constatarlo, che ben si addicono ad un provveditore, soprattutto in un tempo in cui, come avverte lo stesso Elci: «s'è distesa la sua [di Aristotele] dottrina ad esser in tutte le buone scuole maestra di chi impara e di chi sa.»[92]

In base alle suddette evidenze testuali, Papazzoni non può pertanto –lo ripetiamo– essere sensatamente ritenuto l'autore delle *Considerazioni di Accademico Incognito*, le quali appaiono invece, più plausibilmente, ascrivibili –come già riteneva Favaro– alla penna di Arturo Pannocchieschi d'Elci.

Per quanto sia certo che il professore bolognese abbia preso parte alla disputa, difendendo, davanti al Granduca, il punto di vista peripatetico, tuttavia, assai verosimilmente, egli si astenne con cautela dal metter qualcosa per iscritto, sia perchè pressato dagli impegni attinenti all'insegnamento pisano, sia per non trovarsi nella imbarazzante eventualità di uno scontro con il suo "benefattore" Galileo (cui doveva l'ottenimento della lettura pisana), e sia, forse, perchè, sulla questione specifica, non aveva elaborato alcuna soddisfacente argomentazione.[93]

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[91] Ibid., IV, 177.27-178.1.

[92] Ibid., IV, 147.10-1 (dalla *Dedica*, firmata da Arturo d'Elci).

[93] Ciò emerge dall'analisi di alcuni passi della lettera di Papazzoni a Galileo del 30 settembre 1612. Lo scienziato –come si evince con chiarezza dal testo– esortò l'aristotelico a scrivere qualcosa sulla questione idrostatica, ottenendone tuttavia un imbarazzato, seppur non definitivo, rifiuto. Papazzoni adduceva a motivo della rinunzia, i fastidi e le fatiche connesse agli impegni accademici. L'impressione suscitata dal brano, è che il bolognese nutrisse delle remore a schierarsi contro il patrocinatore della sua candidatura alla cattedra pisana, e che,

Ad avvalorare quest'ultima ipotesi, contribuisce una comunicazione di Castelli a Galileo, del 2 febbraio 1613, che merita di essere riportata integralmente:

> Il S.^{r} Amadori –scrive il matematico, riferendosi al medico Giovanni Battista Amadori (1567-1621)– ha fatto un bel tiro. Dopo aver detto al Colombo [Ludovico Delle Colombe] che il Papazzoni l'ha burlato, l'ha consigliato e ristretto a questo, di fare che il Papazzoni sottoscriva alla lettera, che già ha scritta al Colombo, queste parole: *Ed io mi obligo a difendere per vere tutte le proposizioni scritte in questo Discorso Apologetico*, con dirgli: <In questo modo il S.^{r} Galileo risponderebbe, e sarà chiaro che il Papazzoni non vi ha burlato>. Ma se egli ricusa di far questo, resta altresì manifesto che quello che il Papazzoni scrive, lo scrive non con saldezza filosofica, ma con leggerezza di cerimonia o derisione adulatrice. Questo partito non è poi stato accettato dal Colombo per un degnissimo rispetto che V. S. intenderà, cioè (e fu pensier del Palmerino) per non mettere in necessità quel grand'huomo (dico il Papazzone) di far studii novi sopra questa materia. Nel qual consiglio io scopro che loro stessi, gloriandosi dell'applauso ed assenso del Papazzoni, conoscono di gloriarsi della lode datagli da un barbagianni, poichè tengono tali habbia lodato per buono un discorso senza haver in pronto le ragioni di tal loda.[94]

La situazione descritta dal Castelli non è, a dire il vero, chiarissima. Potrebbe, in prima istanza, sembrare che il brano faccia riferimento implicito alle *Considerazioni* dell'Accademico Incognito, come opera di Papazzoni («quello che il Papazzoni scrive...»). Ma, a legger con attenzione, si parla di un documento –una lettera a Ludovico Delle Colombe, il principale oppositore galileiano nella controversia idrostatica– che il bolognese avrebbe steso in sostegno del *Discorso Apologetico*, un lavoro che il Delle Colombe pubblicò nel dicembre 1612 («tengono tali habbia lodato per buono un discorso senza haver in pronto le ragioni di tal loda.»). I fatti potrebbero, allora, essersi svolti al modo seguente: Papazzoni avrebbe inviato una lettera al Delle Colombe in cui lo blandiva e ne elogiava l'opera. Al tempo stesso, però, il bolognese avrebbe continuato a tenere i contatti con Galileo e con i suoi seguaci, conservando, in un difficile equilibrio, buoni rapporti con entrambe le fazioni.[95] A questo punto, Giovanni Battista Amadori denuncia la cosa al

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inoltre, molto probabilmente, non si sentisse adeguatamente preparato ad intervenire nel dibattito, mettendo sulla carta specifici, convincenti argomenti. Cfr. ibid., XI, 405-6.

[94] Ibid., XI, 478.14-27.

[95] Che Papazzoni avesse un atteggiamento oscillante ed ambiguo, lo si desume anche dalla già citata lettera a Galileo del 30 settembre 1612. In essa, il filosofo si profonde in scuse e puntualizzazioni che sembrano mirare all'unico scopo di non urtare la suscettibilità galileiana. Cfr. ibid., XI, 405.12-6.

Delle Colombe, e gli suggerisce di mettere il Papazzoni con le spalle al muro, costringendolo a schierarsi e a sciogliere la sua ambiguità con una dichiarazione scritta. L'aristotelico fiorentino, tuttavia, rifiutò il consiglio, per timore che l'ignoranza in materia idrostatica del Papazzoni (il quale certamente sarebbe stato attaccato da Galileo, nel caso di una sortita a favore del Colombe), potesse nuocere alla causa peripatetica.

Il punto importante emergente dal racconto di Castelli, è che Papazzoni risulta abbastanza privo di conoscenze specifiche sui temi idrostatici, talchè per ribattere ad una eventuale replica galileiana, egli avrebbe dovuto «far studi novi sopra questa materia». E' presumibile, dunque, che, pur dibattendo la questione davanti al Granduca, Papazzoni non ne approfondì mai veramente l'indagine, rinunciando di conseguenza alla redazione di qualunque scrittura sull'argomento.[96]

In base ai risultati emergenti dalla disamina appena compiuta, può concludersi che la consueta attribuzione delle *Considerazioni di Accademico Incognito* alla *verve* polemica di Arturo Pannocchieschi d'Elci, appare certamente più fondata della nuova ipotesi del Drake. La ricognizione delle vicende connesse alla disputa idrostatica, ci ha inoltre consentito di conoscere meglio taluni aspetti della biografia e della personalità del Papazzoni. Diviso tra il debito di gratitudine che lo legava a Galileo, e la fedeltà al dettato della filosofia peripatetica, il professore bolognese si proclamava «prontissimo» a gioire «d'ogni [...] gloria» dello scienziato pisano, precisando al tempo stesso: «se non per quanto risguarda l'honor mio et la verità in diffender Aristotile».[97] In queste parole, orgogliose e ricche di dignità, egli testimonia la persistenza e il radicamento di una tradizione, quella dell'aristotelismo accademico, che –seppur ormai abbastanza priva di vitalità e di spirito creativo–[98]

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[96] La circostanza è, peraltro, attestata da quanto Galileo e Castelli affermano nella risposta al Delle Colombe: «Ma se per ragioni peripatetiche voi intendeste quelle del Sig. Papazzone, addotte in voce alla presenza del Serenissimo Gran Duca [...] quanto a quelle, il Sig. Galileo non è così mal creato che si mettesse a publicar con le stampe atti o ragioni o discorsi fatti in voce da chi si sia, e massime per confutargli, non gli parendo onesto il privar alcuno del benefizio del tempo e del poter pensarvi sopra, corregergli e ben mille volte mutargli.» Ibid., IV, 517.12-20.

[97] Ibid., XI, 496.3-5.

[98] Come ha rilevato Charles Schmitt: «Sebbene la scolastica aristotelica si sarebbe ancora protratta per qualche tempo nelle università italiane, essa era certo sopravvissuta alla sua utilità. Gli aristotelici italiani all'inizio del Seicento erano un gruppo piuttosto stanco ed esaurito, degni obiettivi dello sdegno di Galilei.»

rappresentava ancora, agli esordi del secolo XVII, il perno del sistema educativo degli atenei italiani. Nel contempo –come abbiamo avuto modo di constatare considerando gli sviluppi della controversia idrostatica– le vicende alle quali Papazzoni prese parte, mettono in luce l'asprezza e la radicalità del dibattito intellettuale in un ambiente –quello pisano e fiorentino dei primi decenni del Seicento– fortemente segnato dalla dirompente valenza culturale dell'opera galileiana. E questo è ancora un segno, tra i tanti, della complessità e del fascino di un'epoca della storia delle idee più che mai contraddistinta dalla incessante e lacerante dialettica tra continuità e innovazione.

C. B. Schmitt, "Cesare Cremonini: un aristotelico al tempo di Galilei," in: *Quaderni del Centro Tedesco di Studi Veneziani* 16 (1980), 6.

PRINCIPLE AND METHOD: FRANCESCO BUONAMICI'S VERSION OF RENAISSANCE ARISTOTELIANISM

Hans Kraml

Francesco Buonamici professes to follow Aristotle and his great commentators, above all Averroes, in developing his methodology of science.[1] It is thus not surprising that his theory is, at least at first sight, little different from the theories of others, be they predecessors or contemporaries. In accordance with the general attitude of medieval and Renaissance philosophers he restricts the application of the term "science" to infallibly certain knowledge. He stresses the importance of method for the attainment of such knowledge. His lengthy treatise "De motu" is largely meant to show how it is possible to begin with things known to man and to arrive at things that are more knowable by nature.[2] This distinction, repeated over and over again from Aristotle through the Middle Ages to the Renaissance, is rather alien to the modern usage of the term "science". I think that this distinction must be understood from the background of the restrictions set for knowledge to be scientific. Scientific knowledge can only be had of universals; it must be certain and timeless. This in turn means that scientific knowledge is only of perpetual, timeless, universally occurring things or facts, whereas prescientific knowledge is of things which are unstable, change in time and are particular or even singular. These are known to us because we are more or less immediately acquainted with them. But this, although it may be knowledge, is not scientific knowledge. Scientific knowledge requires its objects to be perpetual and universal, and these are therefore more knowable by nature. These are the objects of scientific knowledge proper.

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[1] *Francisci Bonamici Philosophi Florentini in Pisano Gymnasio profitentis De Motu libri 10*, Florence 1591 (hereafter: Buonamici, *De motu*), 2G, 13C-D.

[2] W. A. Wallace, *Galileo's Logic of Discovery and Proof* (Boston Studies in the Philosophy of Science 137), Dordrecht 1992, 7.

1 Principles and their acquisition

In order to arrive at scientific knowledge, one has to start with that knowledge which can be gained from ordinary experience.[3] This is one main source of the principles that are the basis of science, the other two being induction and definition. General principles of scientific knowledge are acquired by induction, by which the similarities of several singular things are summarised. By induction we realise that equal parts remain if equal parts are taken away from things that are equal.[4] Similarly the senses provide principles: through our senses, for example, we perceive that water is cold, as well as the other first qualities of the first corporeal things.[5]

1.1 Some remarks on the concept of induction

At this point, I would like to remark that the example given for induction throws an interesting light on the concept of induction itself. This case does not seem to be an example of inductive reasoning as it is conceived nowadays. It seems rather to be a case of the logic of equality and to follow from the definition of "equal"; it is, however, a case that could hardly be treated in a syllogistic manner. This could give rise to the impression that this principle is not a case of deductive (syllogistic) inference, but nevertheless it is a case of logical conclusion which is called "induction" to distinguish it from syllogistic deduction.

A similar remark may be made about the case of the abstraction of similarity from singular things. One might be tempted to conceive the following scenario: at the market of Athens I watch Plato, Socrates, Gorgias and Kallikles; I realise that they have something in common through which they are similar and I therefore call them "men". Now I conclude that everything that is similar to them has the same thing in common with them, in virtue of which it might also be called a "man".

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[3] Buonamici, *De motu*, 4H et passim.

[4] Ibid., 4G: "Nanque inductione percipimus, si ab aequis aequa demantur, aequa esse quae supersunt."

[5] Ibid.

This conclusion is not a deductive one, therefore I call it inductive because it goes from several cases to all cases.

I think that such a scenario is profoundly misleading, although it is an idea common to many of those who try to explain how one arrives at universal predicates.[6] The whole idea is misleading because it assumes that one can arrive at the discovery of similarities before one has learnt the act of predication, and because it assumes that things that are similar must have something in common. I omit this second assumption because, taken at face value and verbally, it is utterly unintelligible. Taken metaphorically, as it perhaps should be, it does not provide what one is looking for, namely, an explanation of predication, because it presupposes the ability to predicate. It is parasitic upon the possession of a predicative language and not an explanation for it.[7]

The first assumption—that one discovers similarities and imposes names on these—is at the very least questionable. It presupposes that it is clear what it means for two or more things to be similar before one has any viewpoint from which to compare the things in question. The same is true of equality. I do not deny that we may sometimes be struck by an obvious similarity, and that we might be unable to distinguish between certain different things because they are equal as far as our ability to distinguish is concerned. But this does not mean that predication is learnt by grouping together similar things and naming them. On the contrary, it seems that a child first learns to distinguish things following the distinctions made by grown-ups in their actions and talk. It takes a fairly long time and needs a good deal of linguistic competence before a child is able to group things together according to similarities, and even then the similarities a child finds are often rather surprising. Nevertheless, a child at this stage has little difficulty in making correct predications.

There is another aspect to the whole idea. It is not difficult to give explicit definitions of "similarity", "equality" and "identity" or of the corresponding relational terms using predicates learnt in advance, but I cannot conceive of any definition of predicates in general using only these relations. It is of no help for someone to be told that he should learn the predicate "red" by calling all things similar to one another in redness "red". This is utterly circular. Neither is it of any use to show someone a red book and to tell him that he should call all things similar to that book "red", because the pupil does not know what kind of similarity he should look for (let alone the fact that he cannot know what is meant by "similar"). Clearly it is of no help to tell him that he should look for similarity in colour only, because he cannot know what "colour" means without having learnt to use at least some colour-predicates.

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[6] Cf. W. Burleigh, "De universalibus realibus," in: Gualterus Burlaeus, *Super Artem Veterem*, Venetiis 1497, repr. Frankfurt a.M. 1967, fol. 3v.

[7] As I understand it, "pluralitas non est ponenda sine necessitate," in the sense of "parasitic explanations are to be avoided" rather than some dubious "principle of parsimony," is the point of "Ockham's razor" (and of course of Aristotle's also). Cf. e.g. Aristotle, Top. 8,11 (162a24-25). For Ockham's version, quoted above, see *Scriptum in librum primum Sententiarum. Ordinatio*, Liber I, Prol. q. 1, Opera Theologica I, ed. G. Gál and S. Brown, St. Bonaventure/New York 1967, 74.

The process involved here is quite different, but, and this is of real importance, it is a process of Aristotelian epagoge, of induction in the sense of Aristotle, which is not to be confounded with induction in a modern sense. It has to be stressed that Buonamici's example of taking away equal parts of equal things to have equal parts left is a perfect example of induction in the Aristotelian spirit. For Aristotle, induction is a process by which one becomes aware of and acquainted with a universal pattern through the presentation of a few examples (perhaps even only one!). If one has understood the example, one immediately sees that the exemplified connection is universally valid. I need only one case of Buonamici's example to know that the sentence expressing it is universally valid and true (if some relevant and fairly trivial conditions are taken into account). I need only one example to see that it is universally true that the area of a square is doubled by taking the diagonal as the side of the new square.[8] It is not, as is often presented in modern theories of induction, that a regularity is assumed from a limited number of cases; it is rather a rule that is learnt from a few examples. This is the case of epagoge in mathematics and similar exact sciences (for instance in logic). Although it is somewhat different in other sciences, there is nevertheless the same general idea behind the conception of induction for these. It is not regularities that are discovered by induction, but rules, and especially the rules of predication and classification which have to be learnt.

If I am taught to use the predicate "horse" correctly I am forced by my teachers to call certain tokens (of animals, but it is not necessary that I know that much in advance) "a horse" in distinction from other tokens. After some trial and error my teachers expect me to be able to begin to sort out the right tokens as candidates for being horses on my own. What I am being taught here is not to make any inferences but just to follow a rule. The ability to follow rules is prerequisite to making inferences. To me, this seems trivial. But there is more to it. Advancing in my language-course, I learn that horses together with cows, dogs, elephants, ants, perhaps girls and boys, are examples of animals (by now, let us assume, I can distinguish cows from horses and apply correctly the predicates "cow", and so on). Again I do not learn what life is and then make an induction from certain properties of horses and cows to their being animals. Much less do I infer from the fact that those horses I became acquainted with were animals, that all horses will (probably?) be animals. This would rather show that I had not learned the lesson I was supposed to learn. That horses are animals is not a contingent regularity but a matter of necessity,[9] although I have to be taught this by the use of examples.

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[8] This can be regarded as Plato's example of epagoge. Cf. Menon 82b-85b.

The necessity involved here is of a different kind from the necessity required in mathematics. This, according to Aristotle, is responsible for the different degree of certitude in different sciences. Nevertheless, the principles of any science are provided by this type of procedure, called epagoge and translated into Latin as inductio.[10] Any demonstration of scientifically true sentences in Aristotle's sense ultimately rests on certain premises that are definitely true, but whose truth can only be shown by induction in this sense. Only these premises are principles.[11] According to Buonamici it is a methodological error to assume something as a principle that can be demonstrated within the science concerned.[12]

1.2 The role of the senses

One main source of principles for any science is experience. Experience depends mostly on the senses. Therefore the senses are to be considered as fundamental. They are necessary for each science to arrive at principles.[13] Experience is characterised as springing from the memory of things repeatedly presented to the senses.[14] Repeated sense impressions cause memory and many instances of memory provide experience. Knowledge stems from the experience of first principles. Induction, which primarily leads to these principles, rests on experience, hence ultimately on the senses. The credibility that may be attributed to demonstrations is entirely dependent upon the reliability of the principles gained from sense-experience. For these principles there is no further cause from which they could be derived. Principles are sentences or propositions[15] consisting of terms. The truth of these principles does not depend on further propositions, but only on the relation of the terms within the sentence expressing such a principle. We know these principles because our mind conceives the indubitable connection of the terms, having gained those terms through the senses.[16] This is the main reason for me to think of these principles as rules of predication and not as statements of regularities. The difference I want to direct attention to is indicated in some examples of Renaissance philosophers. Zabarella, for example, uses the—now famous—example of the black raven.[17] It is well known that all ravens are black. Until now no white or coloured raven has appeared. Nevertheless, this case is not one from which one could attain principles for a science. That ravens are black is not essential for them, and although it might be the case that no single white raven has or will ever exist, it is not necessary for anything to be black in order to be a raven.[18] Thus I assume that for Renaissance Aristotelianism this type of case is not of any scientific importance. If in fact all ravens were black, this would be nothing but a simple regularity. On the other hand, it would be clear that even a white raven must be a raven, hence a bird, hence a vertebrate, hence an animal and so on. This is not a case of regularity. It has to be assumed as a rule that something that is not a vertebrate could not be a bird and therefore not a raven either. This is not derived from the observation of regularities but is learnt together with the predicates “raven”, “bird”, “vertebrate” and so on, which are relevant in this case. The meaning of some if not all of these predicates has to be learnt by observation and examination of some exemplars. Yet it is clear that once I have learnt that birds are vertebrates, I need not dissect a raven in order to detect whether it is a vertebrate or not.

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[9] Saul Kripke and Hilary Putnam, among others, have stressed similar points.

[10] To those who do not like the Wittgensteinian overtones in some of my remarks I have to apologise. Unfortunately I am unable to understand the texts of Aristotle and his followers without transposing them into a world in which I feel at home. In order to justify some of my remarks I would refer to K. v. Fritz, *Die epagoge bei Aristoteles*, Munich 1964. Some points I have made are made, in perhaps less questionable language, by H. Mikkeli, *An Aristotelian Response to Renaissance Humanism*, Helsinki 1992, 92-101.

[11] Buonamici, *De motu*, 4F.

[12] Ibid., 6A and passim, especially 101B.

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[13] Ibid., 5B.

[14] Ibid., 4H.

[15] Ibid., 5C: "pronunciata vero & propositiones sunt proxima principia cognitionis, & demonstrationis."

[16] Ibid., 5B: "neque enim caussa vlla est, cur vera sint: sed quod ita principiorum termini se habent, ut aut indissolubili vinculo connectantur, aut quod alter alterius rationem compleat. Ideo noscimus & credimus, quia novit mens eorum terminos, vtrosq. sensu indicante, atque ita certo ut de illorum connexione non dubitet."

[17] Rudolf Carnap and Nelson Goodman both use this example.

[18] Cf. Mikkeli (as note 10), 88. In a different context, Buonamici uses the example of the white swan: *De motu*, 9C.

It seems to me that such considerations are to be found at the root of Aristotelian conceptions of science. Aristotelian science has more to do with the development of conceptual schemes than with empirical laws, but it is not directly in conflict with the search for empirical laws proper. Indeed, quite the contrary is the case. I shall make a few remarks about this at the end of this paper.

1.3 Principles of method

Having settled what is basically required for any body of knowledge to be scientific, namely, that it rest on principles known better and with more certitude than demonstrated propositions, there remains the fact that it is required of any science that the form of its presentation fulfil certain conditions. Scientific knowledge is a special type of knowledge characterised by a certain way of knowing and its being not only true but permanently so. There are certain principles, different from those that govern the content of scientific knowledge, which concern the way in which something is known scientifically.[19] The first of these principles is that in any consideration, but above all in those of natural philosophy, one has to remain true to the judgement of the senses. There is no case in which the senses would not provide the basis of knowledge, because nothing comes to the mind except through the senses, and without the aid of the senses there is only disputation of words. The natural philosopher deals with sensible things and there is no better judge of these than the senses themselves. No demonstration can be accepted if what it demonstrates conflicts with the senses. If one finds, as Parmenides did, that motion necessarily generates a void and therefore is impossible because there is no void, one would do better to admit that there is a vacuum than to propose that there is no motion, because motion is perceived by the senses. Even the most general and most widely accepted principles should be given up if they lead to a conclusion that contradicts the witness of the senses.[20] There is no science at all without the abilities of the senses, and there is no reason to distrust the senses. Certainly every person is deceived now and then. But this does not speak against the reliability of the senses in general. If one does not make hasty judgements on the basis of little evidence, one is rarely deceived. And even if one admits that one can be deceived every now and then by the senses, this does not justify a general doubt with respect to their reliability. When the senses are dealing with their proper objects there is no room for serious doubt. It is of no use to distrust the senses and to rely upon reasoning instead, because all reasoning necessarily starts from things known by the senses. The only alternative would be a worthless Pyrrhonian scepticism. If someone does not believe that fire is hot, he might be thrown into it. There are many instances where sceptics could be refuted by doing just what they deny to be the case, as was demonstrated by Diogenes who, asked about the possibility of motion, just stood up and walked around.[21] The primacy of the senses is to be considered as a general principle in any science,[22] but it is not a principle of any science taken as a stock of knowledge; it is a principle of the acquisition of science. In short, it is a methodological principle.

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[19] Buonamici, *De motu*, 5D.

2 Buonamici's methodology

Despite the fact that the word "science" is used with slightly different meanings, there is a universal consensus within the Aristotelian tradition that science in its special, philosophically interesting, sense is knowledge which is gained methodologically, as opposed to knowledge gained by acquaintance and experience (comparable to "know-how" in a modern sense) or by sheer coincidence.

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[20] Ibid., 6H.

[21] Ibid., 7C-D.

[22] Ibid., 6E.

Interestingly, Buonamici uses the word "methodus" in two senses.[23] First, he often speaks of his endeavour in writing "De motu" as "our method" (nostra methodus). In these cases he obviously uses the word "method" in order to characterise the presentation of knowledge on a certain subject in a specific way. He wants to lead the reader (or the auditor, as he himself—for obvious reasons I think—usually says) to a scientific knowledge of the subject he treats by the way in which he presents his material.[24] He stresses that every method consists of two parts: the way of knowing and knowledge (or science).[25] While science explains and defines, demonstrates and teaches the facts subject to the science concerned, for any method it is necessary to know how to treat a subject, by which ways and arguments it may be confirmed and at which place the relevant parts should be posited. Consequently, there are principles not only for the science concerned, but also for the way and mode of knowledge that make this knowledge scientific. The first and most general of these principles is the aforementioned principle of the priority of sense-experience. No reasoning that leads to a proliferation of propositions contradicting the senses is admissible in any science.[26]

To come closer to what is essential for scientific knowledge, one has to examine the different treatments of the mode of knowing relevant for scientific knowledge. Several terms have been used from the times of Aristotle onwards, especially the words "way" (via), "instrument" (instrumentum), "method" (methodus) and "order" (ordo). It is of great importance to know their meanings and the relationship between them.[27] Everything that has to do with the mode of knowing as opposed to the content of different sciences is usually included under method. Buonamici, therefore, begins his methodological considerations with an explication of the word "methodus" that is intended to lead to something like a definition of method.[28] According to Buonamici, Hippocrates introduced the word "way" (hodos, Latin: via) in order to characterise reasoned and argumentative procedure as distinctive of science. The followers of Hippocrates added a special aspect to this by using the word "methodon" derived from the expression "met' hodou" (cum via), thus indicating that it is essential for any science to proceed in a certain way. In this sense, the way of proceeding is indicated as a part of scientific endeavour or an instrument of the argumentative form that is used in scientific inquiries.

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[23] It seems that this is fairly common usage in the Renaissance. Cf. on Zabarella's use of the word "method", Mikkeli (as note 10), 80-1.

[24] It has been remarked that *De motu* tries to demonstrate its own methodological principles through the form in which the whole task is undertaken: cf. W. A. Wallace (as note 2). Unfortunately the work of M. O. Helbing, *La Filosofia di Francesco Buonamici, professore di Galileo a Pisa*, Pisa 1989, is not available to me at present. This is a great loss for the present essay.

[25] Buonamici, *De motu*, 5D: "Quia methodus omnis ex duabus partibus componitur modo sciendi nimirum & scientia."

[26] Cf. note 21 above.

[27] Ibid., 94H.

Interestingly, Buonamici here renders the Greek expression "met' hodou" into Latin as "cum via", but interprets it in the sense of "together with a way" as well as in the sense of "by a way".[29] This shows that he is aware of the different connotations of the Greek word "meta". He translates it with the Latin "cum", alluding to the rare, though possible, use of "cum" in an instrumental sense. However, this is not sufficient to arrive at an understanding of method in its full sense. Therefore, Buonamici proposes to keep the Greek term "methodus" instead of trying to find a new word or a correct Latin rendering of the Greek word.[30] There is more to method than only a way of teaching or a way of learning or even a way pure and simple, although all these meanings have been proposed by the interpreters of Aristotle. What comes closest to Buonamici's intention is the understanding of method as a way of teaching. What he does not allow is the explanation of method as a way of learning or as a compendiary way of presenting materials. A method or a science need not be contained in a compendium, nor is it even required that it be tractable in a compendiary way. It is not a way of learning, because although reason can only distinguish discipline and doctrine as different readings on the same scale, it is doctrine that is prior by nature. The man who is in possession of science is characterised by his being able to teach.[31] Method can be considered as a way of teaching if one does not forget that, strictly speaking, method is not a way but something that is comprised of a way or something of which a way is part.

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[28] Ibid., 95A.

[29] Ibid.: "Primum igitur via pro ratione tractandi scientias ab Hippocrate sumpta est, quam hydon (sic! Of course the Greek "hydon" of Buonamici's text has to be written "hodon") ipse communi voce nominauit. pro eo quod postea methodon, qui Hippocratem secuti sunt, appellarunt, non viam simpliciter; sed meth' hodou, idest, cum via; quasi via quaedam pars esset, siue instrumentum rationis illius qua scientiae tractantur."

[30] Ibid., B.

2.1 The meaning of a "way" in science

That much being clear, it has to be explained what should be understood by a "way". According to Buonamici there are four main senses in which the authorities speak of the way in science:

1. Some speak of method and way interchangeably. The meaning of "way" in their usage is equivalent to the meaning of "method". The explanation of "way" in this sense has to be postponed until method has been explained.
2. In a second sense, a way is spoken of if one refers to the access, the faculties and the means one has to be provided with in order to achieve anything. In this sense, a way includes the instruments or means, the knowledge, and everything that provides us with the insight necessary in order to do something or to inquire into something. The way provides us with arguments and common notions belonging to the faculty by which we are led to the principles of all other faculties.
3. In a third sense, a way is the universal procedure to prepare the expression of science. This comprises two parts: the notion of what the science deals with, and the notion of why it is how it in fact is. There are two main ways under the heading of this third way, namely the way of definition and the way of demonstration. There are several other ways belonging to this general way (for example, the way of division or the way of ratiocination) but these belong to one of the two main ways. Thus division belongs to definition, as ratiocination does to demonstration, as a preparatory stage. Similarly, the way of induction belongs to this third type of way, but it comprises part of the way of demonstration because it provides the principles prerequisite for demonstrations. Therefore, all these ways belong to definition or demonstration respectively. Once we have arrived at definitions and demonstrations we have attained the science we were striving for. Definitions and demonstrations may rightly be called instruments of science because we have attained science if we have arrived at definitions and demonstrations. This third way is therefore the way to

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[31] Ibid.: "Scientis vero signum, & munus est posse docere."

the instruments of science. It is these instruments, applied to their material, which proliferate science, rather than the way to the instruments.

4. The fourth meaning of "way" concerns the progress from actually known principles to something actually unknown though potentially known. Again there are two possibilities. In the first case, starting from principles we know, we might arrive at things unknown to us, yet accessible by way of these principles because they are generated by the principles known. In the other case starting from things known to us, we arrive at things known by nature. Out of these two ways one single way is conflated by which the science of every subject is built up. The progress from things known to us is usually called *resolution*, the way from principles to things hitherto unknown but derivable from the principles is called *composition*. The way resulting from the conflation of the two ways is called *regress* or circle.

2.2 The regress

It is by resolution that we are led from effects to their causes and it is by resolution that we are led to the knowledge of God and of the soul. Therefore, knowledge of them is not science but history.[32] The way by which we are led to the knowledge of the soul is, however, not a simple one. We can go from the objects to their functions and from the functions to the faculties of our soul. The way from the functions to the faculties according to Buonamici is obviously a resolutive one, whereas the way from the object to the function is one of composition. This last point is made clear by the fact that the object is the efficient cause of its functions. On the other hand, the faculties that constitute the soul are directed towards the functions an object may fulfil. In this sense, the functions of the objects are the aim or end at which the soul is directed. In action the way from an end to the means and actions necessary to achieve the end is resolutive, and generally the way from an end to what leads to that end is a resolutive way. It is characteristic of the resolutive way that it is a progression from an end to what is required for the end.[33] Science in a strict sense is only acquired by the contrary way from principles to their effects. There is, however, an order of precedence between these ways. The resolutive way is prior to the compositional way up to the point that it is given to us by nature. Real science is achieved when the regress is made from the principles invented by resolution back to the effects by the way of composition, but this circular movement back to the effects from which a start was made in the resolutive manner is much neglected in the methods. Usually the second process that constitutes the regress is unnecessary, but because there are cases where we have to go from causes to effects that are unknown to us or where causes might generally be known to us prior to their effects, as is sometimes the case in physics and more often in mathematics, we have also to consider the second process. Generally, the resolutive or analytical way is prior; therefore, it is the way with which we start. The compositional way comes second and completes the scientific enterprise. This is the central point at which the ways constitutive of scientific method are interwoven with order. Order, though not essential to science, is essential to method.[34] To follow an order means to locate the different steps in their correct places within the presentation of the results of the scientific enterprise. It has more to do with teaching than with the achievement of scientific results. The way terminates at the preparation of the instruments of scientific knowledge, whereas order indicates the place at which the object of the science, its principles and parts are to be explained by their instruments and reasons.[35]

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[32] Ibid., 97 C: "Propterea resolutione perducitur in notitiam Dei Optimi Maximi, & in animi cognitionem quae est principium: itaque eius cognitio non scientia, sed historia nuncupatur."

2.3 The meaning of "method"

The meaning of the word "method" is derived from the use of the ways as explained above. As is the case with the word "way", its meaning is not uniform, and, therefore, it has to be distinguished according to the different uses made of it by different authors and at different occasions.

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[33] Ibid., D: "Sed speciali quadam vi resolutio est progressus a fine ad ea quae sunt eius gratia."

[34] Ibid., 107B: "Ergo ordo est essentia methodi, non scientiae."

[35] Ibid., 103A-B: "Itaque aliud est ordo a via. quod (vt dictum est) via terminatur fabrica instrumentorum, & sumit nota, vt ex his instrumenta conflentur, sed ordo nobis suppeditat locum in quo res subiecta, principia, partesq. sunt suis instrumentis & rationibus explicanda."

1. According to Aristotle, method is the rational procedure in preparing the instruments by the use of which science is achieved. In this sense, method comes close to a way in the third sense described above.
2. In a second sense, used frequently by Galen, method is the general or universal rational procedure used to treat any theme or to act on anything. This comprises two main aspects, called by Aristotle art and experience. In this sense the different ways are brought together into one common way by which different particular things are covered under one heading from which in turn singular cases can be recognised and explained in detail.
3. In a third sense, method is an instrument that explains and gives credit or promotes confidence.
4. In a fourth sense, method is a doctrine that proceeds by means of correct reason to those things that are to be known. Here, method is mainly concerned with teaching. According to Aristotle there are two principles underlying this type of method, namely, knowledge of the things to be treated and erudition. For the teacher this means that he has to be well acquainted with his subject and that he has to be able to prepare the way for others to follow an exposition of the subject. Erudition consists mainly in the ability to dispute and to criticise reasonably and profoundly. This requires the knowledge of the technique of argument and proof as delivered in the Analytics of Aristotle. Every bad doctrine has its roots in the neglect of the theory of demonstration.[36] Therefore, erudition does not consist in experience or in the knowledge of the Analytics only, but is a habit that consists of two habits, the acquaintance with and experience of the things by their frequent use, and the analytical habit.

   This habit is also required of the pupil, although in an inchoative manner. An apt pupil will be eager to inquire into things by their frequent use, thus gaining experience, and to analyse things, thus becoming aware of the importance of the Analytics and prepared to study these deeply in advance.

In this sense, method is generally useful for any human enterprise, be it theoretical or practical. For both purposes, method is twofold as indicated. It is resolutive where we have to arrive at principles, and compositive where definite science has to be gained. In the case of theory, the principles of knowledge have to be introduced by resolution; for practical purposes the means have to be considered for an end conceived in advance. Once the relevant means are attained, the compositional way has to be applied in order to find out how to arrive at the desired end by the use of the means at hand.[37]

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[36] Ibid., 100H: "Neq. est hoc solum iudicium Aristotelis, sed etiam sapientissimi Galeni qui quodam in loco ait initium prauorum dogmatum illud vnum esse nihil de demonstrationibus prius esse contemplatum; verum vna res inquirere & tanquam scientem quid sit demonstratio; tentare demonstrationes afferre."

As for science, method is the process from things prior by nature to things posterior by nature, directed by reason and a way. This way is characterised as starting from definitions and principles and passing from things prior to things posterior, but there is a special case here. This is the case of inference in a strict sense, which means syllogistic reasoning. Only in syllogistic reasoning do we find a necessity of inference. This is part of the way of composition and ultimately creates science proper.

2.4 The characterisation of science

Science can now be characterised in two ways. Firstly, science is knowledge gained by method and order in the form described above; secondly, it is acquired through notions that are affections or passions of the soul. As such, they create habits in the person who acquires the science if he repeatedly deals with scientific operations. It is typical for a scientific habit that it becomes something like a demonstration that stays persistently with the person having it. A person is in possession of science if she is able to produce the knowledge and the demonstrations for this knowledge without difficulty and without hesitation. The habit of science is not to be confused with a deep and affectionate conviction of something, but is a stable and permanent disposition to produce the knowledge together with its foundations and demonstrations.[38] Thus, in the end, the science of a person is judged by her or his ability to teach.

To sum up:

1. Every scientific enterprise can be called a method if it fulfils certain conditions.

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[37] Ibid., 99D.

[38] Ibid., 106G: "nanq. vt in ceteris actus actum similem facere studet, sic actu sciens in id institutus est, vt alterum scientem faciat, quod est docere, & id cum prestare valeat; tum didicisse et scire censetur. & signum scientis esse creditur posse docere."

2. These conditions can be formulated by characterising method in a stricter sense.
    - 2.1 In a stricter sense, method is to be characterised as a way or ways of access to the subject of whichever science is to be acquired.
    - 2.2 These ways prepare the instruments or means by which scientific knowledge is to be acquired. The basic instruments are resolution and composition. Resolution comes first in the order of procedure, being the instrument of invention. Composition comes second, making actually known what potentially had been known through the principles which resolution has established. Taken together as one way, they form the method of regress.
    - 2.3 Actual science is gained by the way of composition. This way applies the instruments established by the way of resolution and confers credibility on the results by explaining the facts under examination.
3. The right order of procedure as indicated under 2.1 to 2.3 is essential to method. Order is external to science proper.
4. The continual use of method creates a habit of science. This is a stable and permanent habit of demonstration by which the possessor of the habit is not only firmly convinced of what he or she knows, but, above all, is able to demonstrate his or her knowledge. The sign of this is her or his ability to teach.

3 Concluding remarks

Taken as a whole, the methodology of Buonamici—and, I assume, of Renaissance philosophers in general—is a fairly reasonable and rational theory, as is Aristotle's. It seems to me to be a rational reconstruction of scientific procedure in general at an extremely high and abstract level. It seems to me also that this is exactly the reason why it looks completely useless as a guide to the solution of any scientific problems. In fact, I think that it cannot have been meant to fulfil this sort of function. Perhaps it was not meant to be anything other than a rational reflection on the basic ideal underlying every and any scientific enterprise. The application of the regressive method may be considered to be an essential requirement for an enterprise to be called scientific. This is an explanation of the term "scientific" and a restriction on its application, and far less, if at all, a guide to actual scientific work. It certainly did not guide the scientific work of the growing sciences in the modern sense of the word during the

Renaissance, just as modern theories of science do not guide modern research work in any established scientific field.

It is important to see that this does not compromise the type of work undertaken by philosophers of science from Aristotle onwards, whatever practical scientists might say. From the viewpoint of the whole enterprise of human life, scientific questions are simply a continuation of the questions set for the sake of orientation in life. Every human action is guided by theories of different kinds, mostly by everyday theories of how to achieve desired ends using certain practices and instruments that serve as material and technical means in a broad sense. This is the domain of practical experience. From its beginnings, the ideal of science had to do with the idea of not only doing what one knows, but of knowing what one does. This idea may still be applied to science itself. Although scientists usually proceed by applying procedures they have learnt to use as they ought, it is still of interest, even for the scientists themselves, to know what they do. Consequently one need not be astonished if scientists sometimes take over the role of philosophers. This is as it should be, as long as scientists are human beings. In many cases they disagree with professional philosophers. Even this is as it should be, or so it seems to me. The scientist reflects on his work from inside, the philosopher looks on from outside the scientific work. Provided that philosophers and scientists can talk about their respective findings, this is an important contribution to the general task of orientation in life.[39]

It is not too surprising that at the time of Galileo there were many convergences at the abstract level of methodology between otherwise differently thinking people. It has been shown that the methodology of regress was not only common to Renaissance Aristotelians, but was shared by Galileo.[40] To me it seems that this is due to the fact that the methodology of regress gives a fairly reasonable account of what scientific work is like. Structurally it is in many respects comparable to accounts of the contemporary theory of science. The so-called "deductive nomological scheme of explanation" uses a law (or a general statement) as one premise, a specialised version of the antecedent as second premise, and deduces a specialised version of the consequent as conclusion. The whole deduction can be interpreted as an explanation of the fact expressed in the consequent or a prediction of it. Structurally this fulfils the requirements for the compositional procedure in Renaissance philosophy. The laws or general statements used in this deduction may be justified or "corroborated" by their effectiveness for prediction, but they may also be known to be valid for other reasons. This, it is generally maintained, belongs to the context of discovery. Now at least some cases may be cases of induction in the epagogical sense of the Aristotelian tradition as discussed above. These cases are the typical cases of the application of the regressive method. It is often said by those who explain the regressive method that if something is true of a genus, it is also true of the species belonging to the genus. If one knows that something belongs to a genus per se, one knows that it belongs to all its members, although it might belong to a species only per accidens. (It might be accidental to cows to ruminate, but to ruminate belongs per se to ruminants. If one knows that cows are ruminants, one does not have to repeat what has been said about ruminants. This is an external argument for order in science.[41])

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[39] For more detailed reflection see J. Mittelstrass, *Der Flug der Eule*, Frankfurt a.M. 1989. It is a pity that the work of the "School of Constance" (Jürgen Mittelstrass, Friedrich Kambartel and others) and the "School of Erlangen" (Paul Lorenzen and his disciples) in Germany are little known in the English-speaking world. Recent developments in philosophy seem to exhibit a certain convergence of ideas of some streams in the English-speaking world with the ideas of these schools in Germany.

[40] Wallace (as note 2), 181-8.

Linking together what Aristotelianism demands of principles and what it says about method, one could stipulate as a hypothesis that the whole task of science is to create a normalised language and a framework within which to treat the questions arising from everyday experience. What is new to science in the modern sense (especially physics) is the addition of a powerful mathematical apparatus to some such framework. This apparatus allows numerically exact prediction of the course of events given antecedent conditions which are describable numerically. It is here that the place of the empirical aspect of science within a conceptual framework is to be located. This is the reason why methodological considerations, although much more sophisticated nowadays through the use of mathematical and logical tools inaccessible to earlier eras, still seem structurally equivalent or at least very similar to those considerations with which Aristotle had set the entire enterprise of science on its way.

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[41] Cf. Buonamici, *De motu*, 102E.

NON-REGRESSIVE METHODS (AND THE EMERGENCE OF MODERN SCIENCE)

Heinrich C. Kuhn

That modern, "real" science had to fight its way against Renaissance Aristotelianism, a current as intellectually alive as mutton, that Renaissance Aristotelians were as interested in the *real* texture of nature as my pencil, that sixteenth- and seventeenth-century Aristotelianism was nothing but a bookish nuisance and a hindrance that emergent modern science had to overcome: nobody who is reading Galileo's *Dialogo*[1] without specialist interest can refrain from accepting this as common-sense knowledge. Ernest Renan, who laid the foundations of modern investigations into Renaissance Aristotelianism, gave expression to this common-sense knowledge, claiming that Paduan Averroism (as Renan choose to call the Northern Italian Renaissance Aristotelianism) was insignificant as a philosophy, that the only legitimate interest in that philosophy could be that of the historian in the pursuit of the liberty of thought, whereas the true philosophy of modern times is the positivist experimental science which did away with Renaissance Aristotelianism,[2] that mere pseudo-philosophic movement.[3]

Thus, when, in 1940, John Herman Randall published his paper *The Development of Scientific Method in the School of Padua*,[4] a paper in which he tried to show that the method of modern science was in fact developed by those same Paduan Aristotelians so despised by Renan, when he tried to prove that it was an Aristotelian method, the so-called *regressus*, which was the method of modern science, and to demonstrate that “the ‘father’ of modern science in fact turns out to be none other than the Master of those who know,”[5] the reverberations were considerable. Although today there is little doubt that the emergence of “modern science”[6] happened not only *against* an Aristotelian context, but also *within* an Aristotelian context, the role of *regressus* in this process, the question of the method of “modern science”, and of the degree to which it is identical to *regressus*, the question to what extent—if any—*regressus* is to be found in Galileo’s texts on nature, has been the subject of considerable dispute.[7] One of the few indisputable results of these disputes has been a considerable concentration of those dealing with Renaissance Aristotelian methods on just one of these methods: *regressus*. *Regressus*, to quote Matthias Flacius Jr.'s definition of Zabarella's *regressus*-theory in his epitome,[8] is "a reciprocate demonstration in which, after we have demonstrated an unknown *cause* from a known *effect*, we convert the major proposition, and demonstrate the same *effect* from the same *cause*."[9] With the hope of enlarging our understanding of

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[1] Galileo Galilei, *Dialogo sopra i due massimi sistemi del mondo tolemaico e copernicano*, ed. Libero Sosio, Torino 1970.

[2] E. Renan, *Averroès et l'averroisme essai historique*, Paris ^{3}1866, 414-5.

[3] Ibid., 324.

[4] The paper first appeared in the *Journal of the History of Ideas* 1 (1940), 177-206. I am using the reprint, which includes footnotes with Latin quotations, in: J. H. Randall, *The School of Padua and the Emergence of Modern Science* (Saggi e Testi 1), Padua 1961, 13-68.

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[5] Ibid., 63.

[6] Although I fear that this “modern science” which is the science we have today, of which Galileo Galilei was one of the founding fathers, and which also had forerunners in the middle ages, may be little other than a historographical artefact, I think that it should be kept in mind that the 16th and 17th centuries did know a number of non-aristotelian, alternative models for the explanation of nature, and that the unseating of aristotelianism as the main framework for the interpretation of nature in favour of new, and until now rather successful, frameworks had its origin in these alternative models. The essentials of physical theories of those such as Cardano, Telesio, Fracastoro, Galilei, Kepler, Descartes may have had little in common with our own contemporary science, but they were seen by their authors and their contemporaries as theories which claimed to be superior to the “official” aristotelian science of nature, and thus showed that aristotelianism was not the only possible framework for the explanation of nature and that it might be worthwhile to try other models. At least in this way they are part of the history of “modern science”. (In my *Galileo Galilei come lettore di Cesare Cremonini*, Quaderno dello Centro tedesco di studi venziani, Venice 1993, I have tried to show for the case of Galileo that the core of his thought does indeed have far more in common with the thought of the 16th/17th century philosophers of nature than with our own “modern” science.)
A note on terminology: throughout this paper I shall use “physics” to refer to the 16th and 17th century terms “scientia physica”, “philosophica naturalis”, “physica”, etc. With the exception of the term “modern science” I shall use “science” to refer to “scientia”.

[7] Discussing—or even just listing—all the relevant literature on this subject would require a (lengthy) paper of its own. I am sure that taken together the papers in this volume will give at least the essential references, so that I can refrain from doing so here. Throughout this paper I have indicated only a minimum of secondary literature in order to gain space for primary sources. For introductions to the authors discussed here see: W. Risse, *Die Logik der Neuzeit,* Vol. 1: *1500-1640*, Stuttgart-Bad Canstatt 1964; C. H. Lohr, *Latin Aristotle Commentaries II: Renaissance Authors* (Unione academica nazionale Subsidia al “Corpus Philosophorum Medii Aevi”), Florence 1988; E. J. Ashworth, “Traditional logic,”

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in: C. B. Schmitt, E. Kessler and Q. Skinner (eds), *The Cambridge History of Renaissance Philosophy*, Cambridge 1988, 143-72; Lisa Jardine, "Humanistic Logic," in: ibid., 173-98. For Italian authors see *Dizionario biografico degli italiani*. For German authors see *Allgemeine Deutsche Biographie* and *Neue Deutsche Biographie*. For Jesuit authors at Ingolstadt see L. Boehm (ed.), *Biographisches Handbuch des Lehrkörpers der Universität Ingolstadt - Landshut - München*, Vol. 1, forthcoming. For a consideration of some of the authors discussed here from a different perspective, see B. Lawn, *The Rise and Decline of the Scholastic "Quaestio Disputata" With Special Emphasis on its Use in the Teaching of Medicine and Science, Education and Society in the Middle Ages and Renaissance*, Leiden 1993.

[8] Matthias Flacius, *Opus Logicum in Organon Aristotelis Stagiritae, Summi Philosophi*, Frankfurt 1593, 775: "Regressus dicitur reciprocata quaedam demonstratio, qua postquam causam ignotam ex effectu noto demonstravimus, maiorem propositionem convertimus, & eundem effectum per eandem causam demonstramus."

[9] To illustrate Flacius' definition, the "classic" example of a *regressus* may be illuminating:

First syllogism from effect to cause:			
What does not twinkle	is near.	(maior)	
The planets	do not twinkle.	(minor:	effect)
The planets	are near.	(conclusio:	cause)
Second syllogism from cause to effect:			
What is near	does not twinkle.	(maior, "converted")	
The planets	are near.	(minor:	cause)
The planets	do not twinkle.	(conclusio:	effect)

For many authors the *regressus* contains an additional middle phase between the syllogism "upstairs" from effect to cause and the syllogism "downstairs" from cause to effect. This phase considers the relations between the effects experienced and the causes inferred are considered (e.g. Flacius, ibid., 776: others are referred to by Randall [as note 4]). Some of the authors claim that by this consideration we pass from a confused knowledge of the cause to a distinct knowledge of the cause. As Zabarella seems to be seen by many as the one model renaissance aristotelian logician, it might be worthnoting here that several renaissance logicians deviate from Zabarella's use of the terms "confused knowledge" and "distinct knowledge". (For Zabarella's use of the terms see Iacobus Zabarella, "Liber de Regressu", in: *Opera Logica*, Cologne 1597, cc. 484-6. Different uses of the terms is to be found in, e.g., Collegium Conimbricense Socientatis Iesu, *In Octo Libros Physicorum Aristotelis Stagiritae, Prima Pars*, Cologne 1609, c. 69;

Renaissance Aristotelian methods *this* paper will seek to analyse methods which are not *regressus*.[10]

When we consider Philip Melanchthon's account of the invention of gunpowder, we encounter a method of this type, which does combine conclusions drawn from effects to causes and conclusions from causes to effects, but which is not *regressus*: Melanchthon says in his *Initia Doctrinae Physiae* that we have clear and direct experience of sublunary things: for instance, we know *by experience* that there is heat in fire and coldness in earth and water, and that heat and coldness fight against each other.[11] He tells us, furthermore, that when you reason about natural

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in Dominicus de Soto Segobiensis *Super Octo Libros Physicorum Aristotelis Subtilissimae Quaestiones*, Venice 1582, 23a-24b; and in Cesare Cremonini's commentary on the third book of *De anima* (MS Venice, Biblioteca Nazionale Marciana, Lat. cl. VI, cod. 192 (=2838), fol. 14v ff.)

[10] As I shall argue towards the end of this paper, I believe that further light may be thrown on the emergence of modern science by taking this approach.
For the use of the word "method" in numerous authors see N. W. Gilbert, *Renaissance Concepts of Method*, New York 1963. I shall use the term "method" here to refer to any path that leads us to the acquisition of knowledge. Cf. e.g. the definition given by Hieronymus Balduinus, *Expositio aurea in libros aliquot Physicorum Aristotelis, & Averrois super eiusdem Commentationem; & in prologum Physicorum eiusdem Averrois*, Venice 1573, 63b; Ioannes Eck, *Aristotelis Stagyritae [!] Acroases Physicae Libri VIII. Ioanne Argyropilo [!] Interprete, Adiectis Ioannis Eckii Adnotationibus & commentariis,* Augusta Vindelicorum 1518, fol. 3vb; Petrus Fonseca calls method the "via et ratio" (Petrus Fonseca, *Institutionum Dialecticarum Libri Octo*, Cologne 1567, 205); Franciscus Toletus believes that it is method by which we make manifest the occult, distinguish the confused, refute errors and confirm truths (Franciscus Toletus, *Opera omnia philosophica*, Cologne 1615, c. 4a). There is, therefore, contemporary support for my use of the term "method", although I am well aware that for many authors of the 16th and 17th centuries "method" is simply the order in which things should be taught. This *second* meaning of "method", which is not the one used in this paper, can be found in Collegium Conimbricense Societatis Iesu, *Commentarii In Tres Libros De Anima Aristotelis Stagiritae*, Cologne 1600, 14; Flacius (as note 8), 79vff.; Augustinus Hunaeus, *Dialectica, Seu Generalis Logices Praecepta Omnia, Quaecunque ex toto Aristotelis Organo*, Antwerp 1566, 139ff.; Cornelius Valerius, *Tabulae; Quibus Totius Dialecticae Praecepta Maxime Ad Usum Disserendi necessaria breviter & summatim exponuntur, ordine perspicuo digestae*, Antwerp 1582, 33; to some extent in Rodolphus Goclenius, *Lexicon Philosophicum Quo Tanquam Clave Philosophiae Fores Aperiuntur*, Frankfurt 1613, [Reprint: Hildesheim 1964], 683.

[11] Philip Melanchthon, *Initia Doctrinae Physicae in Academia Vvitebergensi. Iterum edita.*, Wittenberg 1559, fol. 14v.

things you either reason from causes to effects, or from effects to causes,[12] but he does *not* say that you are to combine those ways of reasoning into a *regressus*. What he says is that our physical knowledge for the most part stems from experience, and from reasoning from effects and signs to causes. Thus we know from the regular movement of the sun that the sun is not a mere vapour, an exhalation of earth, because we know from experience that such vapours disintegrate in the air.[13] He who investigates physics is able *by experience* to divide the heavens from the changeable sublunar elements; he is able to distinguish the elements by observing their different motions.[14] It is experience that teaches him the properties of the elements and the effects of these properties: for example, that heat is active, that it brings together things which are similar and separates things which are dissimilar,[15] that heat is affected by moistness, and so on.[16]

Knowledge of this kind can be quite useful, as can be seen in the case of gunpowder. We have knowledge about charcoal: we know that it is greasy enough to serve as a basis for other substances which have properties which are extremely adverse to each other; we know that the element wood, from which charcoal is formed, is by nature hot; we know that sulphur is airy and earthy and easily inflammable; we know that saltpetre is hot and reacts vigorously against anything else which is hot. All this is knowledge that can be acquired by experience.[17] According to

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[12] Ibid., fol. 21r.

[13] Ibid.

[14] Ibid., fol. 21v.

[15] We, as investigators of a later era of "fully emerged" modern science, and investigators into books rather than nature, acquire this information on the properties of heat not by experience, but by reading Aristotle's *De generatione et corruptione* II, 2 (329b26ff).

[16] Melanchthon (as note 11), fol. 21v.

[17] Ibid., fols. 21v-22r: "Et hinc iudicari corporum alterationes multae, & multarum effectionum causa [!] deprehendi possunt, ut in pulvere tormentario, subiectum est carbo tiliae, qui est crassior pars, sustinens duo contraria, quae quasi huic aluo [!] inseruntur, scilicet, Sulphur & Nitrum. Aiunt enim, Tiliam omnium arborum calidissimam esse, deinde Sulphur natura viscosa aèrea & terrestris, facillime inflammatur, & concipit ignem. Nitrum vero ut Sal acerrime, repugnat igni, quandam ipsum etiam calidum est, & vim habet pellendi singularem. Hoc exemplum eo recensui, quia ostendit qualitates habere miram varietatem effectionum, & ex animadversione harum effectionum, multa iudicari in corporibus."

Melanchthon, as I understand him, what happens when you add a burning match to gunpowder is the following: the fire you add to the gunpowder inflames the sulphur and the charcoal; the temperature of the compound rises, and the charcoal, which served as a moderating basis, burns; the hotness of the now un-moderated saltpetre reacts harshly against the hotness of sulphur and the burning charcoal; you get an explosion.

Melanchthon tells us that both a posteriori reasoning (reasoning from the effect) and a priori reasoning (reasoning from the cause) had their part in the invention of gunpowder. He seems to imply that you come to know about the inner properties of things like charcoal and sulphur by reasoning from the effect, i.e. from the way charcoal and sulphur behave in contexts which are not gunpowder, to the cause, i.e. to the inner properties of sulphur, saltpetre and charcoal.[18] Once you know those inner properties, you can deduce by a priori reasoning what will happen when you bring charcoal and sulphur together with saltpetre and add a burning match: thus you invent gunpowder, not by a *regressus*, since the effects you start from—the inflammablilty of sulphur and the greasiness of charcoal—are not the effect you arrive at—the explosion of gunpowder—but probably by a combination of reasoning from effect to cause and from cause to effect.

The invention of gunpowder was certainly a major contribution to modernisation, but even in Melanchthon's time it was not exactly a new invention. In the rest of this paper I shall investigate the non-regressive methods thought appropriate for enquiry into those parts of nature which were held to be not yet understood as well as they might be. These are the methods of *definition, division* and *induction.*[19]

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[18] Ibid., fol. 22r: "Monet etiam a posteriore iter esse in hac inspectione & consideratione ac priora. Nam inventor pulveris tormentarii deprehendit hanc vim pellendi esse in his rebus iunctis, cum vidit exemplum seu experimentum aliquod. Deinde vero effectus multa monet de causis, videlicet de qualitatum natura. Cumque semper respondent experimenta, non potest incerta aut fallax dici haec cognitio. Quare teneamus quod verissimum est, esse multarum rerum in natura veram & certam cognitionem, etiamsi non omnia investigari possunt."

[19] *Division* is called a method by Fonseca (as note 10), 205, and by Rodolphus Goclenius. The latter also counts *definition* and *induction* as methods (as note 10), cc. 684-5. Jacob Schegk also defines *division* and *definition* as methods (*Perfecta Et Absoluta Definiendi Ars, Ab Aristotele Tractata Et Exposita sexto Topicorum*, Tübingen 1556, 129). Ovenus Guntherus' equation of method and dialectics is interesting (*Methodorum Tractus Duo*, Helmstedt 1586, fol. 21r: "Methodus seu Dialectica"). A somewhat similar view seems to have been taken

As I see no possibility of differentiating between different currents of Renaissance logic in such a way as would conform to the minimum standards claimed by Renaissance logicians for such divisions, I shall now treat definition (and later the other methods) without any such differentiation.

Aristotle himself had set strict standards for *definition*.[20] Amongst these standards is the demand that anything must be defined by reference to something which is ontologically prior to it.[21] However, Aristotle says that there are cases in which this rule cannot be observed, as in some cases the possibility of definition would otherwise be excluded altogether.[22] In his *Liber de diffinitione*, Boethius, who transmitted a good deal of Aristotelian and other material to the Latin West, paid far less attention to the validity of definitions than Aristotle had done,[23] but he made up for this by giving a list of fourteen types of definition, several of which would probably not have filled the "Master of those who know" with enthusiasm.[24]

The great importance of *definition* is stressed by a number of the Renaissance authors discussed here. For Laurentius Valla definition is to be considered *regium censor*.[25] Hieronymus Balduinus e Montearduo

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by Toletus (as note 10), c. 4a, who claims that the office of dialectics is to teach method. Since dialectics was commonly divided into definition, division and argumentation, and argumentation was generally subdivided into two imperfect types, example and enthymema, and two perfect types, i.e. syllogism and induction, and since syllogisms have their part in *regressus*, I have chosen in this paper to deal with definition, division and induction as non-regressive methods. (Examples of the standard division of dialectic can be found in: Ioannes Caesarius, *Dialectica in X. tractatus digesta*, Lipsia 1532, fol. L4v; Ioachim Fortius Ringelbergius Andoverpianus, *Dialectica*, Lipsia 1535, fol. B5r; Philip Melanchthon, *Dialectica*, Paris 1532, fol. 3v; Iacobus Schwaiger (Praeses), *Theses Logicae De Scientia Experimentali Acquisita*, Ingolstadt 1627, 9; Valerius [as note 10], 27.)

[20] Aristotle, *Topica*, e.g.: 101b35, 102a2, 122b11, 131b37, 139b15, 139b32, 141a25, 141b26, 142a2, 143a15, 143b10.

[21] Ibid., 141a25.

[22] Ibid., 142a26ff.

[23] J. P. Migne, Patrologia Latina, 64, cc. 891ff.

[24] Ibid., cc. 901ff. Definition by description, by the contrary, by metaphor, by example, by praise, or by analogy is clearly rejected by Aristotle but accepted by Boethius.

[25] Laurentius Valla, *Dialecticarum disputationum Libri tres eruditiss*, Cologne 1541, 125.

claims that the second demonstration of a regressus has to start from a definition[26] and that definition is the most noble and excellent instrument of obtaining knowledge in the whole realm of logic.[27] For Balduinus all knowledge (scientia) is true because of definition, which is the *principium sciendi* in all science.[28] Similar to this is Jakob Schegk's assertion that definition is the starting point for all science and that no science is possible without definition.[29] Augustinus Hunaeus believes that demonstration is necessary for science, but that definition and division are necessary not only for all science but for all the *artes* as well.[30] Fabianus Hippius does not go that far, but he points out that there are questions, which cannot be answered by the use of syllogism, but only by the use of definition.[31] For the Jesuit philosopher Ludwig Vogel of Ingolstadt definition is again the *verus modus disserendi*,[32] the cause of the certainty which is found in a *demonstratio propter quid*,[33] and nobler than demonstration.[34]

Of course there are authors who demand that for such a noble instrument of science the strict rules known from Aristotle be observed. Thus Rudolphus Agricola, despite his statement that his dialectics is intended for the use in the court room and for instructing the public on questions of morals,[35] demands that all definitions be composed from genus and difference.[36] Ovenus Guntherus writes that a definition must always give the *causa finalis* of the thing defined,[37] that it aims at the *essence* of the thing defined and must not contain any accidentals.[38] He explicitly criticises the low standards orators use for their arguments.[39] Augustinus Niphus draws a sharp distinction between definition, which must always consist of an indication of *genus* and *differentia*, and other forms of explanations of what a certain thing is.[40] Antonius Rubius writes that definitions aim only at the *quidditas* of the thing defined, not at any other of its properties.[41]

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[26] Hieronymus e Montearduo, *In Libellum Porphyrii De quinque vocibus... Eiusdem commentaria in libros Aristotelis de interpretatione absoluta*, Venice 1562, fol. 225va.

[27] Ibid. fol. 236rb. He goes on to argue that whatever else is considered in logic has "attributionem ad definitionem;" definition is the *finis* of demonstration; definition has a nobler subject than demonstration; it is more certain than demonstration, and it has a better "preparatio a natura" (fols. 236rb ff.).

[28] Hieronymus Balduinus e Montearduo, *Expositio aurea in libros aliquot Physicorum Aristotelis, & Averrois super eiusdem Commentationem*, Venice 1573, fol. 13ra.

[29] Schegk (as note 19), fol. B1v.

[30] Augustinus Hunaeus, *Dialectica, Seu Generalis Logices Praecepta Omnia*, Antwerp 1566, 137.

[31] Fabianus Hippius, *Problemata Physica Et Logica Peripatetica*, Wittenberg 1611, 100.

[32] MS Munich, Bayerische Staatsbibliothek, Clm 27771, *Organum Aristotelis, seu Ratio Humana logice formata*, fol. 268v. (The manuscript was written in 1628 by Peter Feichtinger at Ingolstadt.)

[33] Ibid., fol. 269r.

[34] Ibid.

These champions of the strict view of definition appear to have formed a minority even in their own time,[42] and most of their contemporaries have far more lenient views on what can be considered a legitimate and valid definition. Ioannes Caesarius in his popular and long-selling[43] *Dialectica in X. tractatus digesta* names fifteen different kinds of definition: definition by essence, by action, by quality, by description, by name, by difference, by metaphor, by the contrary, by naming the exemplary cause, by example, by indicating that of which the defined thing is a part, by praise (Caesarius points out that Aristotle himself defined *philosophy* by praise!), definition by analogy or proportion, by indicating something to which the defined thing is related, by cause.[44]

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[35] Rodolphus Agricola, *De inventione Dialectica Libri Tres*, Strasbourg 1521, fol. 1vs.

[36] Ibid., fol. 9r.

[37] Guntherus (as note 19), fol. 49v.

[38] Ibid., fol. 50r.

[39] Ibid. fols. 57rff.

[40] Augustinus Niphus, *Dialectica ludicra tyrunculis atque veteranis utillima peripateticis consona*, Venice 1521, fol. 20va-b.

[41] Antonius Rubius: *Logica Mexicana sive Commentariii In Universam Aristotelis Logicam. Pars Posterior*, Cologne 1605, 699.

[42] A definite statement to this point would of course require knowledge of all the relevant works of that period, whereas this paper is based upon a selection of something over fifty texts mainly from the libraries in Wolffenbüttel and Munich.

[43] Risse (as note 7), 25, n. 83, mentions that the work went through at least forty editions between 1529 and 1579.

[44] Caesarius (as note 19), fols. N2v-N4r. A list resembling Caesarius' but in a different order and with an attempt at systemization is found in Valerius' *Tabulae*

Georgius Trapezuntius permits amongst others definition by description;[45] Johannes Wirth accepts accidental definition and non-causal essential definition, definition by enumeration of the parts of the thing defined and definition by mutual relation;[46] the Collegium Complutense includes definition by description of the *passiones propriæ* of the thing defined[47] and by enumeration of its accidents.[48] Melanchthon recognises definition by enumeration of the parts of the thing defined or of its accidents, and declares that all intuitive knowledge is knowledge of a definition;[49] further, he stresses the importance of correct *nominal* definitions.[50] Franciscus Toletus permits *definitio descriptiva seu accidentaria*,[51] and causal definitions that do not encompass all four causes;[52] he also mentions that there are questions which can be answered only by the use of *accidental* definitions.[53] Laurentius Valla defines definition by means of what is strictly a description in the terms of the authors discussed here.[54]

Quite a number of these authors, however, state that definitions complying with the strict rules demanded by the first group of renaissance authors mentioned in this section on definition are indeed very desirable and to be used wherever possible, but admit that in some or many cases definition according to less vigorous standards is unavoidable. The

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(as note 10), 82. Varius' definitions of the types of definition are, however, not always the same as those given by Caesarius.

[45] Georgius Trapezuntius, *Dialectica*, Strasbourg 1516, fol. D6v.

[46] Ioannes Hospinianus Steinianus [Johannes Wirth], *Quaestionum Dialecticarum libri sex*, Basel 1557, 229; 235. For Wirth only causal definition is definition by genus et differentia (ibid.). A definition by mutual relation is e.g. the definition of a mother by the relation she has to her child or children.

[47] Collegium Complutense S. Cyrilli Discalceatorum Fratrum Ordinis Beatae Mariae de Monte Carmeli, *Philosophicum Hoc Est Artium Cursus Sive Disputationes In Aristotelis Dialecticam Et Philosophiam naturalem*, Frankfurt 1629, 4a.

[48] Ibid., 4b.

[49] Melanchthon, *Erotemata Dialectices*, Wittenberg 1557, 88. For the last aspect cf. Agricola's statement that for knowledge of the definition it is sufficient to take a thorough look at the thing to be defined (as note 35), fol. 10r.

[50] Melanchthon, *Dialectica* (as note 19), fol. 5v.

[51] Toletus, *Opera omnia* (as note 10), 6b.

[52] Ibid., 7a.

[53] Ibid., 8a.

[54] Valla (as note 25), 127.

Collegium Conimbricense has extremely high standards for the *cognitio comprehensiva* of a thing, demanding that it comprises not only the cognition of *all* its causes, but also the cognition of all possible effects, properties and forces that flow from its essence, and the cognition of all the states this thing might acquire;[55] their demands of *perfecta cognitio* are, however, already lower: here the cognition of accidental causes is unnecessary;[56] lower still are the requirements for a *cognitio defintiva in certo scientiæ*, in which the knowledge of the so-called internal causes—matter and form—is sufficient.[57] Because of this it is possible for physics to obtain perfect science in its *genus*.[58] Petrus Fonseca desires perfect definitions that give the *essence* of the defined thing,[59] but he writes that for some things only a description is possible, and not an essential definition,[60] while others must be defined by means of their acts,[61] and still others in terms of their relations.[62] Furthermore, he states that the less perfect way to acquire a definition is better accommodated to the way in which we acquire knowledge.[63] Augustinus Hunaeus, who is very interested in *nominal* definitions,[64] and acknowledges five non-essential types of *definitio rei*,[65] states that essential definition ranks highest amongst all types of definition, and that it alone is definition proper, but that it is only rarely attained because of the difficulty of knowing *cuiusque rei abditam rationem*.[66] Hunæus' views may have been inspired by Melanchthon, who also assigns great importance to *nominal* definition,[67] knows non-essential types of definition,[68] holds that *essential* definitions are rare,[69] and is well aware of the imperfections of human cognitive capacities.[70] Benedictus Pererius writes that the knowledge of *causa prima, forma prima* and *ultimus finis* is necessary for a *cognitio perfecta* but not for other types of science.[71]

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[55] Collegium Conimbricense (as note 9), 62: "Quarta assertio. Cognitio comprehensiva rei non solum perceptionem omnium eius causarum; sed etiam effectuum, quos possit edere, & proprietatum ac virium, quae essentiam consequuntur, & denique omnium perfectionum, quae in naturali eius potenti continentur, efflagi<t>at." Even Thomas Aquinas, whom the Coimbra Commentators cite as an authority for those demanding requirements on comprehensive cognition (ibid., 62f.), seems to hold a somewhat more lenient view: "Rei cuiuslibet perfecta cognitio haberi non potest nisi eius operatio cognoscatur. Ex modo enim operationis et specie mensura et qualitas virtutis pensatur, virtus vero naturam rei monstrat: secundum hoc enim unumquodque natum est operari quod actu talem naturam sortitur" (Thomas de Aquino, *Summa contra gentes*, Darmstadt 1982, ii,1 3).

[56] Collegium Conimbricense (as note 9), 61.

[57] Ibid., 62.

[58] Ibid.

[59] Fonseca (as note 10), 221.

[60] Ibid., 203.

[61] Ibid., 205.

[62] Ibid. Fonseca writes that *relata* are defined by the things to which they are related, but he also states that they are defined by the relation they have to the things to which they are related (ibid. 217).

[63] Ibid., 209.

[64] Of which he discusses ten types: Hunaeus (as note 10), 120-3.

The situation of *division* is very similar to that which I have tried to describe for *definition*. Considerable importance is attributed to it;[72] some authors plead for high standards for divisions,[73] but an apparently greater number acknowledge the value of high standard divisions, while holding the view that there are many cases in which our only possibility of obtaining knowledge at all is to use divisions that do not comply to the most stringent requirements.[74]

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[65] Ibid., 125; Hunaeus also claims here that he could enumerate additional types of *definitio rei*.

[66] Ibid.

[67] Melanchthon, *Dialectica* (as note 19), fol. 5v.

[68] Ibid., fols. 5v, 23r, 23v, 23v, 24r, where Melanchthon says, that we very often use accidental definitions, since the accidents reveal to us substances otherwise unknown.

[69] Ibid. fol. 20r.

[70] E.g. ibid., fol. 23v.

[71] Benedictus Pererius, *De Communibus omnium rerum naturalium Principiis & Affectionibus, Libri Quindecim*, Paris 1585, 125. On the same pages Pererius shows a greater than average interest in the definition of accidents.

[72] Balduninus writes that division infers with necessity, although not with syllogistic necessity [*Expositio aurea* (as note 10), 687a]. De Soto asserts (I think) that it is *division*, that leads us to cognition [de Soto (as note 9), 23b]. See also Agricola (as note 35), fol. 11v; Caesarius (as note 19), fol. N4v; Trapezuntius (as note 46), fol. D6v; Hunaeus (as note 10), 137; Melanchthon, *Dialectica* (as note 19), fol. 24v; Schegk, *Perfecta Et Absoluta* (as note 19), 129; Toletus, *Opera omnia* (as note 10), 9a.

[73] Thomas de Vio Caietanus, *In De Ente Et Essentia D. Thomae Aquinatis Commentaria*, Torino 1934, 192f; Ringelbergius (as note 19), fol. B8v; Ovenus Guntherus complains of the decadence of the strictness of the requirements for divisions (as note 19), fol. 109r-v.

The last of the non-regressive methods I want to deal with here is *induction*: That a "complete" induction from the knowledge of *each individual* relevant case gives knowledge of considerable certainty is, as far as I know, commonly accepted. But the discussion of the status of *incomplete* induction in 16th century "Aristotelian" texts appears to be of some interest, and as with definition and division some variety of opinion is also found on induction. Some authors are rather fond of it.[75]

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[74] E.g.: Collegium Complutense (as note 47), 6a; Caesarius (as note 19), fol. O1r; Fonseca (as note 10), 182; 183 ("Saepe tamen dividimus totum in partes remotas, quia ignoratae nobis sunt proximae, ac immediatae," and reasons in favour of other otherwise undesirable divisions); 185.
A special case is the statement by Johann Mayr (MS Munich, Bayerische Staatsbibliothek, Clm 24967, *Introductio Ad Dialecticam*, MS written in 1700 by Leonhard Schidrer), fol. 22r, that divisions should go into *membra immediata*, unless the understandability of the division is impaired. For Mayr it is not the imperfection of our cognititive capacities, but the zeal for clear style that makes the use of imperfect divisions desirable. Parallel to this is that when he speaks about *defintions*, Mayr states that the rules for good definitions are not to be observed in all cases, although he does not give any reason for this. Generally I have the impression that Aristotelians' interest in "imperfect" non-regressive methods and the discussion of their use and necessity is primarily a sixteenth- and early seventeenth-century phenomenon. At Ingolstadt University in the second quarter of the seventeenth century the interest in *regressus* seems already to have been waning away, as can be seen by the extremely superficial discussion of it in Johann Vallat's *Commentarius in logicam Aristotelis* (MS Munich, Universitätsbibliothek, 4° Cod. ms. 586, written by Johann Volck in 1631, fols. 603ff. Another MS of this text, written by Martin Dalmair, and dated 1631 is contained, in a volume of *printed* texts in the Munich Bayerische Staatsbibliothek, shelfmark 4° Diss. 1287, but as far as I know up to now uncatalogued. I refer to the University Library ms). This work also lacks any deeper interest in non regressive methods. The waning interest in methods can be seen also in the even more superficial discussion of *regressus* in Ludwig Vogel's *Organum Aristotelis seu ratio Humana logice formata* (as note 32), fol. 255v-7r, although this work still shows some interest in definition. Grounds for the more intense discussion of methodological problems within Aristotelian contexts at least at Ingolstadt University seem by that time no longer to exist. Paolo Rossi's suggestion that "a diminished theoretical certainty about the results of traditional knowledge is the necessary condition for the rise of a "problem of method" ("Il mettodo induttivo e la polemica antioccultista in G. Fracastoro" in: *Rivista Critica Di Storia Della Filosofia*, 9 [1954], 485) would seem to be correct.

[75] For Hieronymus Balduinus induction "est principale instrumentum ad quod omnia alia instrumenta reducuntur ut posteriora ad prius" [*Expositio aurea* (as note 10), 532a]. Matthias Flacius views induction as second only to syllogism in certainty

Laurentius Valla has somewhat sceptical views on all of its types,[76] while in his *scholia* on Agricola's *De inventione* Ioannes Phrisemius declares when dealing with induction that where imperfect forms of argumentation are sufficient, there is no need to use perfect ones.[77] Agricola himself informs us that even incomplete induction is often convincing, but always uncertain.[78] Some authors view incomplete inductions as always imperfect,[79] others want to save them formally by adding an "and the same holds true for all similar cases" to the instances enumerated,[80] which practice is rejected by Ioannes Cæsarius as sophistic.[81] Other authors differentiate incomplete inductions according to the field in which they are used, claiming that incomplete inductions in areas which are ruled by necessity have demonstrative vigour.[82] It is probably against this

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and grade of evidence [Flacius (as note 8), 586], Fabianus Hippius' arguments are in the same vein [Hippius (as note 31), 100]. The basis of such views is Aristotle's *Topica*, I, 12, 105a12.

Hunaeus is of the opinion that it is by induction that we come to know the principles and the arts (as note 10), 261; Schwaiger believes this to be true of universal principles (as note 19), 5, and Franciscus Toletus asserts the same for the principles of the single sciences (*Commentaria, una cum Quaestionibus I Universam Aristotelis Logicam*, Cologne 1616, 453bf).

[76] Valla (as note 25), 315: "syllogismus necessario colligit. Inductio verisimiliter."

[77] Rodolphus Agricola and Ioannes Matthaeus Phrisemius, *De Inventione dialectica libri tres*, Paris 1534, 329 (first numbering: there are errors in the numbering of some pages). Apparently no-one in the tradition of the commentators on *De inventione dialectica* up to Ioannes Noviomagus felt obliged to protest against this by advocating higher standards in this respect, since Noviomagus in his edition at this point (as at most others) gives no *scholia* other than Phrisemius' (Rodolphus Agricola & al., *De inventione Dialectica Libri Omnes integri*, Ioannes Noviomagus, Cologne 1570).

[78] Agricola (as note 35), fol. 79v-81r.

[79] Hunaeus (as note 10), 310; Valerius (as note 10), 92.

[80] Phrisemius (as note 77), 319; Balduinus, *Expositio aurea* (as note 10), 58a; Fonseca (as note 10), 316.

[81] Caesarius (as note 19), fol. Iv3r.

[82] The source for this concept of incomplete but demonstrative induction appears to be Averroes' *Commetarium Magnum super physicam*, Venice 1550, II c. 80 and VIII c. 33.

Hieronymus Balduinus gives the following example, taken from Aristotle's *De cælo* (191b15-19): "Luna est sphaerica; ergo omnis stella. hoc quod ignotum erat naturaliter, probat necessario & virtute unius principiii, scilicet quod omnes stellae sunt eiusdem naturae specificae; & ideo quicquid essentialiter competit uni, competit & caeteris. at Lunae competit esse sphaericum: ergo & caeteris stellis.

background of the concept of incomplete but demonstrative induction that Cæsarius' use of induction in mathematics is to be seen,[83] a field of application of induction that is to be found as well in Fracastoro's very differentiated statements on induction.[84]

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ecce quod habet vim demonstrationis" [*Expositio aurea* (as note 10), 58a]. He claims that for such demonstrative inductions the enumeration of one or two instances is sufficient [ibid., 115a]. An epitome of his teaching on induction can be found in ibid., 704b. Mattias Flacius offers the insight that the whole is greater than its parts as an example of information gained by the use of demonstrative induction (as note 8), 791.

[83] Caesarius (as note 19), fol. Iv2v-3r: "Inductio, quae graecis ἐπαγώηγαι dicitur, hoc pacto definitur: Inductio est oratio, per quam a singularibus ad universale fit progressio. Sane per singularia hoc loco intelligere debemus, non solum ea, quae simpliciter talia sunt, ut sunt individua, & numero differentia, verumetiam minus communia respectu ipsius universalis, quod ex ipsis per inductionem colligitur. Ab his enim plerunque universale conflatur, colligiturque, ut si quis velit ostendere omnem numerum esse duorum iuxta se positorum medium, id inductione probaverit, quoniam ternarius medius est binarii & quaternarii, & quaternarius item ternarii & quinarii, & ita deinceps: igitur omnis numerus est duorum iuxta se positorum medius."

[84] Fracastoro's views on induction would be worth a paper of their own; here I shall attempt only a brief summary. The relevant statements are to be found in: Girolamo Fracastoro, "Turrius Sive de Intellectione Dialogus," in: *Opera omnia*, Venice 1555, fol. 180rff. Fracastoro states that complete inductions are sometimes easy (as in the case of the induction leading to the insight that all four elements have rectilinear movements), that sometimes it is legitimate to add '& sic in aliis' to an enumeration (as in the case of judgements on the effects of the specimens of a certain herb), whereas in other similar cases nothing more than probability can be obtained. We attain certainty when we know the *reasons* for the observed effects of a certain herb (fol. 180v). In mathematics incomplete demonstrative induction is possible, but this is not so of propoaitions about natural objects (ibid., fol. 181r [wrongly numbered 185]: "Alio modo necessaria fides fit, cum singularia prorsus similia sunt, & quale unum est, talia esse omnia alia. ut si videam has duas lineas rectas aequidistantes nunquam concurrere, ita de aliis etiam accipiemus, eo quod prorsus sunt similes, quare de omnibus conclusio fiet. & talia sunt mathematica omnia. naturalia vero non ita se habent"). As an example for the impossibility of incomplete but demonstrative induction on natural objects Fracastoro mentioes the experience that not all humans are white-skinned, although Italians, French and Germans are (ibid.). He continues, however, with a statement which brings further differentiation, and permits some certainty of incomplete induction even with inductions on natural things: "sunt tamen quaedam inductiones, quae tametsi probabiles simpliciter tantum sint, tamen adeo propinquae sunt necessariis, ut pro necessariis habeantur: & sunt illae, in quibus ita observavimus & nos, & patres nostri, & avi, & omnis memoria: tum & nationes omnes, in omni loco, omni tempore. ut quod omnia orta occidiant, & quod omne quod movetur sit corpus. in quibus quidem nec omnia singularia possibile est inducere, nec ratio est facta ad communem naturam, nec scimus, an

The use of induction in mathematics, which seems so strange to us today, the use of imperfect types of definition and induction and the assessment of the moderate power of human cognitive capacities necessitating the use of imperfect methods are part of sixteenth- and seventeenth-century discussions on non-regressive methods. The underlying legitimation of the use of imperfect non-regressive methods is, as was to be seen in several cases, the insight that in many cases such procedures offer *us* the only possibility to acquire knowledge at all.[85]

Thus, for some at least of the authors mentioned in this paper, the discussions[86] of non-regressive methods have the effect of legitimating both the use of "imperfect" methods and the claim that a good deal of *scientia physica* is to be obtained not through high-standard methods, but by the use of the low-standard methods which allow for "imperfect" research and argumentation in *scientia physica.*

And this is a point which, I believe, may have been of considerable importance for the emergence of modern science.[87] For as long as any

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prorsus ingularia omnia similia sint: quia tamen ita viderunt omnes, & ubique, & semper, pro necessariis habentur" (ibid.).

[85] The epistomology of Benedictus Pererius seems to be shaped completely by this tension between an emphasis on the imperfection of human cognition and the quest to obtain the best possible knowledge, using "imperfect" methods where no perfect ones are applicable. This would merit a paper of its own as well, and I hope that such a paper will be provided for this volume by Luce Giard. (Especially interesting in this context, it seems to me, are the statements in Pererius [as note 71], 39; 40; 51-6; 114-34;1 41-7.) Melanchthon's natural philosophy and epistemology, which are also influenced by his relatively low opinion of human mental capacities and yet demonstrate a great longing for insight into nature, is admirably treated in Sachiko Kusukawa *The Transformation of Natural Philosophy: The Case of Philip Melanchthon*, Cambridge, 1995.

[86] There were discussions about non-regressive methods as well as about *regressus.* However, as a good deal of the controversies on non-regressive methods is found in text-books for schools and universities rather than in scholarly works, the names of opponents are rarely given, and their theories are rarely discussed in depth. But a look at the various *praecepta* for definition, division, and induction reveals a considerable amount of dissent between the various authors. Unfortunately I do not have space to go into detail here; nor can I offer a discussion of the modern secondary literature on'renaissance epistomology, methodology and natural philosophy.

[87] Of course both the regressive methods leading to the emergence of modern science and the non-regressive methods, which I suggest here, were also of some importance for the emergence of modern science, draw their roots from the *Master of those who know* himself. Aristotle advocates rather low standards for statements about astronomical and meteorological objects (*Meteora* I,7: 344a5-9).

new *scientia naturalis* has to answer the extremely strict requirements of a Cesare Cremonini,[88] and for as long as any *scientia naturalis* has to use only "perfect" methods and has to give "perfect" explanations for the whole of nature, it appears impossible to develop successful alternatives to the Aristotelianism of an Alexander of Aphrodisias, an Averroes, a Cesare Cremonini, which is apparently so perfect in method and contents. In a situation, however, in which there is the feeling that no such perfection is possible in *scientia naturalis* for any human mind and that successful investigation of, and argumentation about, nature need not be restricted solely to the use of "perfect" methods,[89] in a situation which is less confident about the possibilities of human cognition and, therefore, well aware that *all* natural philosophy (including that of Aristotele) is necessarily imperfect, in a situation where it is felt that *no* natural philosophy can sensibly be compelled to the use of perfect methods only, the emergence of new philosophies of nature, still imperfect in content and methods, but not therefore illegitimate, becomes possible: the emergence of the new philosophies of nature of a Girolamo Cardano, a Girolamo Fracastoro, a Bernardino Telesio, a Galileo Galilei, a Johannes Kepler, which form (at least in the traditional retrospective view) the basis for the emergence of modern science.

However significant or insignificant the discussions on non-regressive methods may have been for the emergence of modern science, I hope to have been able to convey to at least some of the readers of these pages the impression that it was not only the discussions on *regressus*

In his *Topica* is interested in a logic that serves not only for thorough and perfect demonstrations, but also for conviction in cases where no such demonstrations are possible or appropriate. Here, as in many other cases Galileo's Simplicio is utterly right: all possible knowledge can be drawn from the works of Aristotle, but it is the interpreter who decides what knowledge to draw from these works, and, as Sagredo points out, the work of such an interpreter has to be equalled to original composition (Galileo [as note 1], 134f [Ed. Naz. vii, 134f]).

[88] E.g. Cesare Cremonini, *Disputatio de cœlo in tres partes divisa*, Venice 1613, 272ff and 2nd numbering 36. I discuss these (and related) passages at some length in my *Venetischer Aristotelismus im Ende der aristotelischen Welt: Aspekte der Welt und des Denkens des Cesare Cremonini (1550-1613)*, Frankfurt am Main 1996, sections 3.7.5.4 and 5.

[89] Of course, such a context, at the same time more "sceptical" and more "liberal", already existed at the time of Cesare Cremonini, whom I cite at note 89 above for his high theoretical demands, and had been in existence for more than a century before Cremonini's *Disputatio de cœlo* (as note 88) went into print. As far as I know nobody has ever accused Cremonini of being excessively progessive...

which deserve attention, but that the 16th- and early 17th-century discussions on non-regressive methods might also be worthy of interest. I myself think that they deserve such interest (as do those on regressus) because of their zeal to determine legitimate methods for the development and presentation of works on natural philosophy in the view of *that* time—which admittedly is incidentally also the time of Galileo Galilei.[90]

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[90] Thanks are due the participants of the Wolfenbüttel meeting for discussing a previous version of this paper with me, to Constance Blackwell for having made that meeting possible, to Sachiko Kusukawa, Jean Dietz Moss, Michele Camerota and Nick Jardine for having shared their work with me, which added considerably to the background and made it possible for me to write this paper. Special thanks go to Manfred Fox for his willingness to try to make my text compatible with correct English, and to anybody who helps me to improve this text and my mind by offering me her or his critical remarks on this text.
Lack of space and memory make it impossible to list all the reading that helped to shape this paper. It may also be said of this paper that what is true in it is common property, and that in many cases we are original only in our errors and mistakes. Perfection is difficult to obtain, not only in *scientia naturalis*.

VINCULUM CONCORDIAE: LUTHERAN METHOD BY PHILIP MELANCHTHON[*]

Sachiko Kusukawa

The question of what counted as a rational and legitimate means of understanding the nature of the natural world—that is, method—in sixteenth-century natural philosophy has been a focal point of study for historians of science. Ever since the seminal paper by Randall, concepts of method have been regarded as crucial to the understanding of the "scientific revolution", based on the assumption that such a revolution would necessarily have entailed some kind of "revolution in method."[1] In this account, the Church-controlled universities of Northern Europe were dismissed as hostile to "science" while the Aristotle of the medics at Padua was seen as having inspired the elaboration of a "scientific method" by men like Zabarella. As Vasoli has shown, however, there was at the same time much concern amongst North-European, reform-minded humanists to establish apppropriate methods of procedure in the arts and sciences through their rhetorico-dialectical works.[2] The impact that the dialectical manuals of those such as Agricola, Valla and Melanchthon had on sixteenth-century thought is considerable, and if we wish to gain a fairer understanding of the possible variety of meanings of method in the sixteenth century, we clearly need to understand the significance of non-Paduan concepts of method. In this paper, I present the case of Philip Melanchthon, friend and ally of Luther, who became renowned as *artifex*

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[*] I am grateful to Professor Nicholas Jardine for helpful comments in improving this paper.

[1] J. H. Randall, *The School of Padua and the Emergence of Modern Science* (Saggi e Testi 1), Padua 1961, first published as "The Development of Scientific Method in the School of Padua," in: *Journal of History of Ideas* 1 (1940), 177-206.

[2] C. Vasoli, *La dialettica e la retorica dell'Umanesimo: "invenzione" e "metodo nella cultura del XV e XVI secolo* (I fatti e le idee Saggi e Biografie 174), Milan 1968.

methodi (master of method) at Wittenberg, the heart of the Reformation. Melanchthon believed that there was a method which established certainty in teaching not only theology but also moral and natural philosophies, and he insisted that students learnt this method. My aim in this paper is to present an understanding of Melanchthon's concept of method by placing it in a larger context of the enterprise for which he designed that method.

Although originally conceived as inseparable from rhetoric, dialectics for Melanchthon increasingly became an important and independent discipline which taught method and certainty through demonstrative arguments. This process can be traced through the successive revisions of his dialectical textbooks.[3] Modern estimation, however, of his idea of method has been far from positive. For instance, Melanchthon falls short of Gilbert's expectation of a humanist, whose major contribution to methodical thinking was to provide the seventeenth century with a "richer background" by handing over a precise and comprehensive knowledge of classical methodology.[4] For Gilbert, Melanchthon did not provide an "extended and probing analysis" of classical concepts of method and thus does not deserve the title of *artifex methodi*. Nor is Melanchthon's contribution to "humanist dialectics" considered to have been constructive. Modern historians generally understand humanist dialectics as centred on the art of persuading more plausibly *in utramque partem*, having started with both sides of the arguments as equally plausible.[5] They were insterested not so much in establishing the formal validity of statements as in the skills with which arguments could be made more plausible and convincing. In contrast Melanchthon insisted on achieving certainty through his method and gave extensive explanations of certain demonstrative arguments. At best, his dialectics is considered a hybrid of Aristotelian demonstration and Ciceronian dialectics.[6] So far, Melanchthon's dialectics has not passed muster.

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[3] W. Risse, *Die Logik der Neuzeit 1500-1640*, Stuttgart-Bad Canstatt 1964, vol. 1, 83-107, though he does not examine the reasons for the changes in Melanchthon's dialectical textbooks.

[4] N. W. Gilbert, *Renaissance Concepts of Method*, New York 1960, 125-8.

[5] L. Jardine, "Humanist Logic," in: C. B. Schmitt, E. Kessler and Q. Skinner (eds.), *The Cambridge History of Renaissance Philosophy*, Cambridge 1988, 176-84. Cf. Aristotle, *Topica*, I, 1; *Posterior Analytics*, I, 1.

[6] L. Jardine (as note 5), 192.

A question remains unanswered, however: why then did Melanchthon bother to produce in such a hybrid way three different editions of dialectic textbooks at all? Clearly, Melanchthon considered method and certainty important and relevant to himself and others. Why? Much work has been done to unravel Melanchthon's debt to classical and contemporary thought in this area.[7] I wish to show how and why Melanchthon considered dialectical method to be crucial for himself. I shall be arguing further that it is only by understanding his efforts in dialectics in a larger context of the ethical and political issues of the Reformation that we may appreciate why method became crucial to Melanchthon in the way that it did.

The first edition of Melanchthon's dialectic textbook, the *Compendiaria dialectices ratio*, was published in 1520. Melanchthon considered dialectics and rhetoric inseparable. In his *De Rhetorica libri tres*, published in 1519, Melanchthon had claimed that the task of dialectics was to provide rules for epideictic oration, not as a classical oration of praise and blame, but primarily as a skill of teaching.[8] From this epideictic oration as a skill of teaching, Melanchthon claimed that both invention and judgment of material for speeches (the two main parts of dialectics) arose and as such led to the other types of orations (i.e. the forensic and the deliberative).[9] Melanchthon was unique in formally linking dialectics and rhetoric with epideictic oration,[10] and the role of dialectics as a basis for rhetorical oration is clearly discernible in the *Compendiaria dialectices ratio*, where he defined dialectics as:

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[7] Melanchthon's possible debt to classical, neo-classical and contemporary authors in rhetoric and dialectics has been amply studied by a succession of scholars, see J. R. Schneider, *Philip Melanchthon's Rhetorical Construal of Biblical Authority: Oratio Sacra* (Texts and Studies in Religion 51), Lewiston/Queenston/Lampeter 1990, 65-95; Wilhelm Maurer, *Der junge Melanchthon zwischen Humanismus und Reformation*, vol. 1: *Der Humanist*, Göttingen 1967, 171-214; Quirinus Breen, "The Terms 'loci communes' and 'loci' in Melanchthon," in: *Church History* 16 (1947), 197-209; P. Joachimsen, "Loci communes: Eine Untersuchung zur Geistesgeschichte des Humanismus und der Reformation," in: *Luther-Jahrbuch* 8 (1926), 27-97; C. Vasoli (as note 2), 278-329. For a concise introduction to humanist dialectics and method in general, see Lisa Jardine, *Francis Bacon: Discovery and the Art of Discourse*, Cambridge 1974, 17-65.

[8] Philip Melanchthon, *De rhetorica libri tres*, Cologne 1521, fols a6r-v: "Versatur enim genus demonstrativum primum in docendo, deinde in laude et vituperio. ... Genus demonstrativum, sive artificium docendi, est quod exacte naturam et conditionem cuiusque rei, certis inscriptam locis sic expedit, ut subterfugere non possit inquirentem, quicquid de instituto sciri omnino licet. ... Porro haec est dialecticae tota fabrica, ratio apodeixeos, hoc est, ordo docendi." For a recent analysis of Melanchthon's rhetoric, see C. Mouchel, "Figures et adéquation dans la doctrine oratoire de Philippe Melanchthon," in: *Etudes Littéraires* 24/3 (1992), 49-62. For the classical division of oratory into the deliberative, the forensic and the demonstrative (which Melanchthon follows in essence), see Aristotle, *Rhetorica*, I, 3, 9. For an overview of classical theories of epideictic oration, see T. C. Burgess, "Epideictic Literature," in: *Studies in Classical Philology* 3 (1902), 89-261.

> *a skill of speaking appositely and fittingly on whatever case.* It displays simply the nature and parts of each case, and prescribes with certain words (*certis verbis*) what is proposed, so that whatever truth or falsity there is in it cannot be overlooked.[11]

Melanchthon followed Cicero's partition of dialectics into definition, division and argumentation.[12] The *Compendiaria dialectices ratio* is divided into four books and Melanchthon begins the first book by providing definitions of predicables such as indivisibles, species, genus difference and accidents and of predicates such as substance, quality, quantity and relation. He then lists five questions as necessary for scrutinising and judging (simple) cases. These are: What does the word signify? What thing is it? What are its causes? What are its parts? What is its function?[13] The sources for these questions were Aristotle's *Posterior Analytica* (II.1) and *Topica.*[14] In book two of the *Compendiaria*

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[9] Melanchthon, *De rhetorica libri tres*, fol. a6r: "Nos a genere demonstrativo vel hoc maxime ordimur, quod ex ipso loci communes inventionis, iudicandi ratio tota nascitur, et ad reliqua genera viam munit." Cf. Cicero's pejorative comment that epideictic oration as "display" is fit for the sophists at gymnasiums, *Orator*, 37-42.

[10] Here I follow Schneider (as note 7), 71.

[11] Melanchthon, *Compendiaria dialectices ratio*, in: Philip Melanchthon, *Corpus Reformatorum, Philippi Melanchthonis opera, quae supersunt omnia*, 28 vols., Halle 1834-60, reprinted: New York 1963 (hereafter *CR*) 20:711: "Dialectica est artificium apposite ac proprie de quocunque themate disserendi. Simpliciter enim cuiusque thematis naturam et partes ostendit, et quod proponitur, adeo certis verbis praescribit, ut non possit non deprehendi, quicquid inest, sive veri, sive falsi" (my emphasis).

[12] Risse (as note 3), 84.

[13] Melanchthon, *Compendiaria dialectices ratio*, *CR* 20:724. Cf. the nine questions given as the "organs" of invention in *De rhetorica libri tres*, fols a7r-v. The places of invention traditionally featured both in dialectic and rhetoric courses; see L. Jardine (as note 7), 32.

[14] For Aristotle's logical topics as analyzing how various kinds of predicates may be attributed to a subject, see O. Bird, "The Tradition of the Logical Topics: Aristotle to Ockham," in: *Journal of the History of Ideas* 23 (1962), 307-23.

dialectices ratio, logical relations of propositions such as contraries, contradictions and subcontraries are discussed. In the third book, forms of argumentation such as figures of syllogism, enthymeme, induction, example and sorites are explained. In book four, *inventio*, the discovery of material for arguments, is taken up. Following Cicero, Melanchthon regards the *loci* as the fount for material of arguments.[15] *Loci* of persons include their race, country, father, sex, age, education, discipline, fortune and so on, which are useful for boys practicising declamations of praises of famous men, while *Loci* of things include their definition, genus, species, differences, similarities and so on.[16] Melanchthon also believed that the *loci* represented rules and forms which governed all things.[17] It is within the discussion of the *loci* that we encounter Melanchthon using the term *methodus*. He explains that there is a methodical way of building argument for proof or disproof of a given proposition, namely by breaking the proposition down into simple terms and then subjecting them to the questions for simple cases as described in book one.[18] Although Melanchthon did consider epideictic orations as concerned with method,[19] Melanchthon's use of the term *methodus* within the *Compendiaria dialectices ratio* is almost incidental. Compared to other terms that are explained, no particular significance or emphasis was attached to it.

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[15] Melanchthon, *Compendiaria dialectices ratio*, *CR* 20:749: "Scripturus es epistolam aut orationem, disputaturus es de rebus philosophicis, de iuris articulis, de sacris, quid scribas aut dicas, loci indicabunt. Aut alienam orationem iudicaturus es, certe consilium eius nunquam deprehenderis, nisi spectaveris, quibus thema locis munitum sit. Tota enim vis inventionis in locis posita est, ex quibus ceu fontibus oratio deduci solet." See Cicero, *Topica*, II, 7. For an analysis of Melanchthon's theory of *Loci*, see Maurer (as note 7), 199-209.

[16] Melanchthon, *Compendiaria dialectices ratio*, *CR* 20:751-63.

[17] Melanchthon, *De rhetorica libri tres*, Eiijv: "Neque vero putes eos [=locos communes] temere confingi, ex intimis naturae sedibus eruti, formae sunt seu regulae omnium rerum" (my interpolation). Cf. Schneider (as note 7), 75-6.

[18] Melanchthon, *Compendiaria dialectices ratio*, *CR* 20:755: "Oratio vero proprie aut probatur, aut improbatur. Nam in oratione proprie verum aut falsum inest. Eritque haec probandi methodus. In omni pronuntiato simplici duae sunt partes, Subiectum et Praedicatum, ut, voluptas est bonum. Inde, ab utraque parte, cum a subiecto, tum a praedicato, argumenta trahentur. Proinde, si quod thema disserendum, probandum, reprobandumve propositum fuerit, dissolve in partes, earumque finitiones, caussas, species, ac membra perquire. Nam ex his argumenta colliges, ut si finitioni, caussis, ac partibus voluptatis cum bono convenit, plane bonum esse colliges voluptatem."

[19] Melanchthon, *De rhetorica libri tres*, fols a6v-7r.

The *Compendiaria dialectices ratio* thus fulfils the promise of its title: that is, it offers a brief guide to dialectics with explanations of basic terminology and modes of reasoning necessary for the orator. Here the concept of method does not fare particularly important compared to other terms that are explained. Melanchthon does not, for instance, insist that students should follow method, or give any explanation of the importance of method.

The second and third editions of Melanchthon's dialectic manuals are further developments of the *Compendiaria dialectices ratio* in that the composition of the books remain virtually the same, with revision and expansion of arguments and addition of new material. From the second edition onwards, however, we can detect a sense of immediacy with which Melanchthon discusses certainty, method and demonstration in greater detail and with stronger emphasis.

When Melanchthon revised the textbook in 1528 and entitled it the *De dialectica libri quatuor*, he intended that it should "pave the way towards lectures on Aristotle."[20] This commentary may well have been used in his lectures on Aristotle's Dialectics and Organon in 1529.[21] In this edition, Melanchthon defined dialectics as

> an art of defining, dividing and arguing. We define when we expound a name or when we explain what thing it is. We divide when we enumerate its members or parts. We produce argument when we reasonably draw out one statement from another.[22]

This is a definition incorporating the Ciceronian parititition already seen in the *Compendiaria dialectices ratio.*

A significant change, however, occurs with respect to method. A new section now clearly sets out the importance of method:

> The ancients called Method the way of teaching correctly and in an orderly manner, following the precepts of dialectics and often urged that we make an effort in all dealings, controversies and arts to maintain method because it would necessarily be the case that an uncertain mind would wander unless it is ruled by this method. And in a way those who master method always teach

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[20] Melanchthon, *De dialectica libri quatuor*, Wittenberg 1531, fol. A3r.

[21] See his announcement dated 15 July 1529, *CR* 1:1081.

[22] Melanchthon, *De dialectica libri quatuor*, fol. A3v: "Dialectica est ars definiendi, dividendi, et argumentandi. Definimus aut, cum aut nomen interpretamur, aut quid res sit exponimus. Dividimus, cum membra aut partes enumeramus. Argumentamur, cum aliam sententiam ex alia ratiocinamur."

> more profitably than those who do not, however much these men may abound in talent.[23]

Method in instruction thus has the result of keeping the wandering and erring mind in check.

Melanchthon then listed some authors whom he regarded as having dealt with their subjects methodically:

> For the students, Aristotle is more useful than Plato with respect to moral and natural philosophy because Plato did not follow the proper method even though he had castigated Gorgias and the like because they were not conversant with dialectics. In medicine Avicenna should be loved by all on account of his method. In civil law the book of Institutes is virtually the method. In sacred letters the letter of St Paul to the Romans is the method. For there is nothing that can be understood profoundly unless our mind informs itself of some method which it follows in thinking about, inquiring about and explaining [that thing].[24]

It should be remembered that the first edition of Melanchthon's first *Loci communes rerum theologicarum seu hypotyposes theologicae* published in 1521 was based on his lectures on Romans. In the *Loci communes* Melanchthon deliberately set out not to be exhaustive (as the scholastic theologians were) but instead concentrated on the "major points" essential to understanding Luther's idea of justification by faith alone.[25] These were indeed the points which Melanchthon had dictated in his lectures.[26] The authors he lists in the above passage as possessing method are thus those whose works contained the essential points of a given subject. These essential points could be found, again, through questions such as: what thing is it (including also "what does it signify?" and "is there such a thing?")? What are its causes? What are its parts? What are its functions or effects?[27]

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[23] Melanchthon, *De dialectica libri quatuor*, fol. L3v: "Veteres Methodum vocant rationem recte atque ordine docendi, iuxta praecepta dialectices, ac saepe monent ut in omnibus negocijs, controversijs, artibus, demus operam, ut Methodum teneamus, quia necesse sit animum vagari incertum, nisi hac ratione regatur, Ac in uno quoque genere semper foelicius docent, hi, qui callent Methodum, quam qui non callent, quantumvis abundent ingeniis."

[24] Melanchthon, *De dialectica libri quatuor*, fols L3v-L4r: "Utilior est Aristoteles discentibus moralem aut naturalem Philosophiam, quam Plato, quia Plato non observavit iustam Methodum tametsi is hoc nomine exagitet Gorgias et similes, quod non satis periti sint dialectices, In Medicina amatur ab omnibus Avicenna, propter Methodum. In iure civili propemodum Methodus est liber Institutionum. In sacris literis Methodus est Epistola Pauli ad Romanos. Nulla res est enim, quae penitus perspici possit, nisi animus noster Methodum sibi quandam informet, quam in eius rei cogitatione, inquisitione, et explicatione sequatur.".

[25] See Melanchthon's preface to his *Loci communes* (1521) in *Melanchthon and Bucer*, tr. L. J. Satre and rev. W. Pauck, London 1969, 20-1. Here, the term "hypotyposes" seems to be more in line with the meaning of a "sketch" or "outline" in the New Testament (I. Tim. 1. 16, II. Tim. 1. 13) than Quintilian's "ocular demonstration" (*Institutio Oratoria*, IX, ii, 40), as identified in Breen (as note 7), 203.

Another significant addition in the *De dialectica libri quatuor* is the section on demonstration. Melanchthon starts off by explaining that there are two kinds of arguments, one necessary, the other contingent. Contingent arguments are probable, but not certain. Aristotle had called them dialectical arguments. They are produced by craft and ingenious skill of the mind.[28] The other, necessary and certain argument, is demonstration. As in mathematics, proofs are the least doubtful in demonstration.[29] Melanchthon advises that the kind of demonstrative proofs which dominate arithmetic and geometry should be used not only in teaching, but in all dealings and debates. By observing such demonstration, Melanchthon claims that there "remains no doubt" in the mind.[30]

Melanchthon then goes on to say that there is an innate knowledge of things known to all people because it was impressed on them by God. Some philosophers have called such knowledge common axioms, or, according to Aristotle, principles, because they are the fount and starting point of all arts. That the whole is greater than its part, and that wicked deeds which disturb human society should be prohibited and punished, are examples of such innately known principles.[31] Unless the mind is impaired, Melanchthon argues, no one can possibly not know these principles. They are as obvious as what we hear with our ears and see with our eyes.[32] Melanchthon's ultimate reason for arguing that these principles are obvious is that he considers them to have been endowed to the human mind by God.[33]

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[26] Joachimsen (as note 7), 29. For Melanchthon's lecture notes, see E. Bizer, *Theologie der Verheissung: Studien zur theologischen Entwicklung des jungen Melanchthon (1519-1524)*, Neukirchen-Vlynn 1966.

[27] Melanchthon, *De dialectica libri quatuor*, fols L7r-v, E5v-E6v.

[28] Ibid., fol. L4r.

[29] Melanchthon defines demonstration thus: "Fiunt Demonstrationes, cum ex definitione definitum, aut e contra, seu cum ex proprijs caussis effectus seu propria officia, seu ex effectibus propriae caussae colliguntur" (*De dialectica libri quatuor*, fols L4r-v).

[30] Ibid., fol. L4v: "Arithmetica et Geometria, quae sunt maxime certae, dominatur hoc genus probationum. Plurimum autem prodest non tantum in disciplinis, sed in omnibus negocijs et controversijs observare, an demonstrationes aliquae in caussa versentur, de qua dicendum est. Nam animadversa demonstratione nulla relinquitur dubitatio."

For Melanchthon, all statements that are certain are derived either from such principles in a proper order (i.e. using syllogistic reasoning which yields good and firm consequences) or are proven from experience (e.g., that fire heats).[34] Certainty in instruction can thus be guaranteed through innate knowledge of principles, syllogistic reasoning and experience. Melanchthon emphatically rejects the Academic skeptics who claim that nothing can be known for certain. Again, Melanchthon stresses that students should learn the difference between what is certain and what is not. It is dishonourable to advance uncertain things instead of certain things. Ignorance of the difference between certain and uncertain things will also hinder judgement.[35]

In this section on demonstration, there is thus an overwhelming concern for certainty in instruction and for the method by which such certainty can be achieved. Even in the disciplines of medicine and law, which Melanchthon concedes contain many probable arguments, he emphasizes that there are a number of certain statements.[36] Moreover, the examples which he gives as certain statements have a specific ethical message. The following is a prime example:

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[31] Ibid., fol. L5r: "Totum est maius qualibet parte, uniuscuiusque naturae est aliquis certus finis, societas generis humani est conservanda. Facinora quae perturbant societatem humani generis sunt prohibenda, ac punienda. Tales sententiae vel de natura, de moribus vocantur a Philosophis aliquando κοιναι εννοιαι, quia sunt universales sentenciae divinitus inscriptae omnium animis quasque natura omnes tenent, Aristoteles principia appellat. Sunt enim inicia et fontes disciplinarum omnium et caussas continent omnium artium."
Cf. R. B. Todd, "The Stoic Common Notions: A Re-examination and Reinterpretation," in: *Symbolae Osloenses 48 (1973), 47-75.*

[32] Ibid., fols L5r-v.

[33] Unlike Aristotle (*Posterior Analytics*, II, 19), Melanchthon is not concerned here to establish the truth of first principles. For his ethical first principles as divinely bestowed on man (*lex naturae*), see C. Bauer, "Melanchthons Naturrechtslehre," in: *Archiv für Reformationsgeschichte* 42 (1952), 64-100.

[34] P. Melanchthon, *De dialectica libri quatuor*, fol. L5v: "Omnia igitur quae sunt certa in doctrinis, profiscuntur a principijs iusto ordine, hoc est, bona et firma consequencia, ut Dialectici loquuntur, aut sunt per experientiam comperta, ut sciri quod ignis caleficiat." H. Engelland suggests that this is a Ciceronian formulation of innate knowledge (introduction to *Melanchthon on Christian Doctrine: Loci Communes of 1555*, tr. C. L. Manschreck, New York 1965, xxvii).

[35] P. Melanchthon, *De dialectica libri quatuor*, fol. L5v.

> Actions which disturb human society are to be prohibited.
> Thefts, freebooting and the like disturb human society.
> Therefore, thefts, freebooting and the like are to be prohibited.
> The major premise is a principle. The minor premise had the evidence of experience and both are therefore most certain. And what lawyers call the law of nature, or, strictly speaking, law of the peoples (*ius naturae aut gentium proprie*) is nothing unless it is knowledge of certain principles of behaviour and civil life.[37]

Most of the certain statements of moral philosophy that Melanchthon offers have to do with civil obedience and order.

The establishment of certainty was still important in the third version of the textbook, the *Erotemata dialectices* published in 1547. In it, Melanchthon defined dialectics as:

> an art or way of teaching in a correct, orderly and clear manner, which is made possible by correct definition, division, connecting true arguments, and by exposing and refuting incoherence and falsehood.[38]

We can readily see that this definition is a combination of the definitions of dialectics and of method from the *De dialectica libri quatuor.* Dialectics is now defined as the method of certain instruction.

In the *Erotemata dialectices* Melanchthon calls the (innate) principles, syllogistic reasoning and experience the "criteria" of certain knowledge.[39] Questions which produce the *loci* are now expanded to ten.[40] Syllogism and Aristotelian categories are more extensively treated, enabling some scholars to consider this edition as a textbook on Aristotelian logic.[41] Indeed, Melanchthon came to regard Aristotle as the one and only *artifex methodi*.[42] The *loci*, however, still formed an important part of Melanchthon's method, and the *Erotemata dialectices* should be understood in essence as a continuation of Melanchthon's effort to establish the proper procedures for absolutely certain arguments.

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[36] Ibid., fol. B8r-v.

[37] Ibid., fols L6r-v: "Facinora quae perturbant societatem generis humani, sunt prohibenda.
Furta, Latrocina, et similia perturbant societatem generis humani.
Ergo furta, Latrocina, et similia sunt prohibenda.
Maior est principium. Minor testem habet experientiam, utraque igitur certissima est. Et quod Iurisconsuti vocant Ius naturae aut gentium proprie nihil est, nisi principiorum quorundam de moribus de civili vita, noticia."

[38] Melanchthon, *Erotemata dialectices*, *CR* 13:513: "Dialectica est ars seu via, recte, ordine, et perspicue docendi, quod fit recte definiendo, dividendo, argumenta vera connectendo, et male cohaerentia seu falsa retexendo et refutando."

[39] Ibid., *CR* 13:647.

What is new in the *Erotemata dialectices* is that method is now defined as "habit":

> Method is a habit, namely a science or an art, making the way with sure reasoning (*certa ratione*). That is, through the confusion of things, just as through a place impassable and covered with thorny bushes, method finds and seizes the way, establishes cases pertinent to the proposition and proceeds in an orderly way.[43]

Habit, according to Melanchthon, "is a quality acquired from frequent human actions," just as Lucas Cranach excelled himself in painting by habituating the art.[44] It is a kind of agility unique to rational beings; just as wax is made malleable with fingers, so human parts can be made more agile by constant use.[45] Constant practice and repetition, then, is necessary for the acquisition of method.

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[40] See Gilbert (as note 4), 126-7 for an estimation of the full list of questions.

[41] Risse (as note 3), 89-90. Cf. Vasoli, who emphasizes the Agricolan, humanistic characteristics of Melanchthon's work in Vasoli (as note 2), 278-309.

[42] Melanchthon, *De Aristotele* (1537), *CR* 11:349: "...planeque ita sentio, magnam doctrinarum confusionem secuturam esse, si Aristoteles neglectus fuerit, qui unus ac solus est methodi artifex."

[43] Melanchthon, *Erotemata dialectices*, *CR* 13:573: "Methodus est habitus, videlicet scientia, seu ars, viam faciens certa ratione, id est, quae quasi per loca invia et obsita sentibus, per rerum confusionem, viam invenit et aperit, ac res ad propositum pertinentes, eruit ac ordine promit." Cf. *De dialectica libri quatuor*, fols B6v-7r, where "habit" has no specific connection with method. For a possible source for the identification of habit with method, see Eustratius, *Commentaria in libros decem Aristotelis de moribus ad Nicomachum*, Venice 1536, a copy of which Wittenberg University Library owned. Cf. Gilbert (as note 4), 48. For the collection of Wittenberg University Library, see S. Kusukawa, *The Wittenberg University Library Catalogue (1536)*, Cambridge 1995.

[44] Melanchthon, *Erotemata dialectices*, *CR* 13:535: "Habitus, Graece ἥξις, est qualitas comparat ex crebris actionibus in hominibus, qua recte et facile homines efficere illas actiones possunt, quae a suo habitu gubernantur et iuvantur, ut, in Luca pictore ars pingendi est habitus, didicit pingere Lucas, et postquam manus assuefacta est, facilius et certius pingit eas lineas, quas mens intuetur et pingere iubet, quam alii rudes pingerent."

Melanchthon then concedes that "habit" becomes perfect only when accompanied by natural talent.[46] Clearly he understood that people had different talents and capacities. This attitude is clearly mirrored in his comments elsewhere about the active and passive intellect. Departing from Aristotle, Melanchthon explained in the *Liber de anima* that some have capacity to discover things (active intellect) whilst others understand and acknowledge what is discovered, just as they accept what is said (passive intellect). Melanchthon also seems to imply that the active intellect is superior to the passive intellect.[47] Melanchthon, however, hardly discusses how these discoveries are made or in what way gifted people may or may not need method.

Melanchthon's dialectics after 1527 is predominantly concerned with inculcating method. It thus seems that Melanchthon was working on the mental capacity which could be trained to some extent irrespective of natural talent. This may be because Melanchthon is here primarily writing as a teacher. It also fits in with Melanchthon's view of man as a moral being. In the *Liber de anima*, Melanchthon explains that human beings are divinely endowed with knowledge of what is good and bad. By divine sanction, their actions ought to conform to these innate norms. Yet fallen human beings, as Lutherans claimed, are so weak in their will that they often fail to attain what God wills. This is where habit becomes important. Frequent actions develop a habit—a firm impetus to desire or avoid the same things constantly.[48] It is this perceived need to strengthen the will to be virtuous, I believe, that led Melanchthon to see method as "habit".

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[45] Ibid.

[46] Ibid., *CR* 13:535-6: "Sed tamen natura hominum talis est, ut alia ad alias artes seu virtutes etiam a natura impetus aliquos habeat, quibus excitatis studio et doctrina citius arripitur habitus, ut cum in Iosquino naturales ad Musicam impetus essent, avidius arripiebat harmonias, et diiudicabat rectius, quam alii. Deinde cum ars accedere, didicit facilius. Ita habitus in eo factus est ardentior et firmior, et altius in ipsos nervos, quibus reguntur sensus, penetravit. Econtra, ubi desunt naturales impetus, etsi utcunque assuefieri talia ingenia possunt, tamen habitus imperfecti fiunt, ut, Choerilus quoquo modo facit verus, sed non fundit simili uberitate et suavitate, ut Homerus."

[47] Melanchthon, *Liber de anima*, *CR* 13:147-8. Compare also E. Kessler, "The Intellective Soul," in: Schmitt et al. (as note 5), 518.

[48] Melanchthon, *Liber de anima*, *CR* 13:167: "Frequentes actiones similes pariunt habitus, id est, firmos impetus, quibus constantius eadem adpetit aut fugit voluntas. Hi habitus nominantur virtutes, aut vicia... Mens iudicans et voluntas

From 1528, we may thus trace in his dialectical textbooks Melanchthon's growing concern for certainty in teaching, especially in ethical matters, and the development of *loci* as the method of teaching. As several scholars have noted, many of Melanchthon's ideas in his rhetoric and dialectics are derived from classical, neo-classical and contemporary authors.[49] What is important to note, however, is that although drawing on several traditions, Melanchthon himself felt strongly enough about method and certainty that he made revisions and additions with particular emphases. In other words, he made dialectics into a tool of his own by which he addressed what he regarded as a live and pressing issue of his time. For there existed in real life those who did not follow method:

> I call unlearned not only those who are ignorant of letters, as are the Anabaptists, but also those inept men who may declaim magnificently and yet speak of nothing certain, and because *they were not accustomed to method*, because they do not sufficiently have a hold on the origin of things, and moreover, because they have not been initiated into philosophy, these people cannot sufficiently see either what theology teaches, or how far it agrees with philosophy.[50]

The development of Melanchthon's dialectics in fact paralleled that of his moral philosophy, and from 1527 onwards, Melanchthon's philosophy was reorientated towards addresssing a pressing issue. In 1527 Melanchthon conducted a visitation in Thuringia during which he encountered Anabaptist practices and civil disturbances.[51] This made a lasting impression on him. He came to be personally convinced that civil disturbance promoted by the radical evangelicals was seriously

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eligens, ac imperans potentiae locomotivae. Et in mente lucent immotae noticiae, quae sunt normae actionum, discernentes recta et non recta. Et ordo divinitus sancitus est, ut ad has normas, quae sunt radii sapientiae divinae in nobis, congruant actiones."

[49] See note 7.

[50] Melanchthon, *De Philosophia* (1536), *CR* 11:282: "Et indoctos voco non solum rudes literarum, ut sunt Anabaptistae, sed etiam illos ineptos, qui cum magnifice declamitent, tamen certi nihil dicunt, et quià ad methodum non sunt assuefacti, et quia fontes rerum non satis tenent, propterea quia cum in Philosophia non sint instituti, non satis videant aut quid Theologia profiteatur, aut quatenus cum Philosophia consentiat" (my emphasis).

[51] For this visitation, see J. S. Oyer, *Lutheran Reformers against Anabaptists: Luther, Melanchthon and Menius and the Anabaptists of Central Germany*, The Hague 1964, 140-78.

jeopardizing Luther's cause. Thomas Müntzer, for instance, who was initially sympathetic to Luther's cause, began to preach passionately apocalyptic and seditious messages, eventually dying with the peasants in an uprising in 1525,[52] while the papal church claimed that Luther was inciting violence.[53] Civil disobedience also became one of the major points on which Melanchthon differed with the Zwinglians. The late 1520s was precisely the time when, in the face of these problems, the Reformation is said to have taken the turn for the "magisterial", namely a Reformation through existing rulers and governments. The inculcation of acceptable social and moral behaviour thus became one of the primary concerns for Lutherans, and it was precisely this issue that Melanchthon sought to address through the teaching of philosophy, including dialectics. Melanchthon's moral philosophy (based upon Aristotle's *Nicomachean Ethics*) explained how man ought to obey civil governments,[54] while his dialectics provided the means with which to prove true moral statements from innate principles endowed by God to all people, regardless of their faith. Philosophical demonstration was for Melanchthon the strongest possible way to prove beyond doubt that even those without the right faith had to obey civil government.[55]

Why then, did Melanchthon consider his *loci* the best way to teach students? When we look at Melanchthon's textbooks (the *Erotemata dialectices,* the *Philosophiae moralis epitome,* the *Liber de anima* and the *Initia doctrinae physicae*), they invariably proceed by the all-important *loci.* Each section is headed with a question such as "Quid est anima?" "Quot sunt potentiae animae hominis?" and "Quid est mundus?" These questions are followed by succinct answers taken from Aristotle, Cicero, Galen and others. That is, the textbooks were written in a simple question-and-answer form, as the term *Erotemata* implies. Nowhere, however, does Melanchthon ever explain *how* to select the *loci* and why a particular selection of topics is justified.[56] The late Charles Schmitt's observation that Melanchthon's textbooks are "catechetical"[57] is quite apposite. Lutherans seized upon catechism—a rote repetition by means of question and answer—not simply because they saw it as a practice of the Early Church, but also because they considered it a most potent and efficient way of inculcating rules of religious doctrine as well as of moral and social behaviour.[58] Thus at Wittenberg, religious teaching was based on catechism, while philosophy was taught with catechetical textbooks.

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[52] For Müntzer, see A. Friesen, *Thomas Muentzer, A Destroyer of the Godless: The Making of a Sixteenth-Century Religious Revolutionary*, Berkeley/Los Angeles 1990, and T. Scott, *Thomas Müntzer: Theology and Revolution in the German Reformation*, Basingstoke/London 1989.

[53] See for instance, Johannes Eck, *Articulos 404*, Ingolstadt 1530, fol. Diiiir.

[54] For Melanchthon's political and moral philosophy, see G. Kisch, *Melanchthons Rechts- und Soziallehre*, Berlin 1967, and now R. Keen, *Divine and Human Authority in Reformation Thought: German Theologians on Political Order 1520-1555* (Bibliotheca Humanistica et Reformatorica 55), Nieuwkoop 1997).

[55] For Melanchthon's reform of philosophy in response to civil disobedience, see further my *The Transformation of Natural Philosophy: The Case of Philip Melanchthon*, Cambridge 1995.

This question-and-answer form did not seek knowledge of why certain questions are asked or why those questions ought to be answered in a particular way. In short, it simply drilled students into producing a single, correct answer. And this was indeed the task of the philosophy faculty at Wittenberg. In 1545, Melanchthon stipulated that:

> since this philosophical assembly should also be a part of the Church of God, we wish all who are received into this college to embrace the pure teaching of the Gospel which our church teaches *unanimously and univocally* with the universal church of God. They should recognise God and His Son our Lord Jesus Christ, and teach philosophy in such a way that they do not corrupt the teaching of the Gospel nor with curiosity or obtuseness, either sow, prove or defend abusive and prophane opinions against God...[59]

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[56] The *loci* to be covered in natural philosophy are listed in Melanchthon's *Initia doctrinae physicae*, *CR* 13:195-7.

[57] C. B. Schmitt, "The rise of the philosophical textbook," in: idem. et al (as note 5), 798.

[58] On the evolution of the question-and-answer form, see C. A. G. Zezschwitz, *System der christlich-kirchlichen Katechetik,* 3 vols., Leipzig 1863-74, 2/2: 1-19; for the Lutheran adoption of catechism, see G. Strauss, *Luther's House of Learning: Indoctrination of the Young in the German Reformation*, Baltimore/ London 1978, 151-75.

[59] *Urkundenbuch der Universität Wittenberg*, vol. I: *1502-1611*, ed. W. Friedensburg, Magdeburg 1926, 268: "Cum hic philosophicus coetus etiam pars esse debeat ecclesiae dei, volumus omnes, qui recipiuntur in hoc collegium, amplecti puram evangelii doctrinam, quam ecclesia nostra una spiritu et una voce cum ecclesia dei catholica profitetur. agnoscant deum et filium ejus, dominum nostrum Jesum Christum, et ita doceant philosophiam, ut non corrumpant doctrinam evangelii nec aut curiositate aut petulantia ingeniorum serant aut probent aut defendant prophanas opiniones contumeliosas adversus deum,... . Leges collegii liberalium artium, quas philosophia continet" (my emphasis).

Drilling students into the correct doctrine through catechetical exercise was meant to achieve unity of thought—unanimously and univocally—without aberration or heresy. That is, it was meant to achieve Lutheran orthodoxy. For Melanchthon dialectics provided the means for achieving this goal. And this, I believe, is precisely why Melanchthon came to regard his dialectics a "chain of concord."[60]

Some may regard this kind of catechetical instruction proceeding by *loci* as downright dogmatic.[61] In a way, I believe, we are here encountering the essence of what Richard Popkin has called the "intellectual crisis" of the Reformation. The Reformers argued that the Papacy had no certain basis for its professed religious truth and that the criterion of traditional authority gave no assurance to the absolute certitude of the Papacy's position. Whilst rejecting the traditional criteria of certainty of knowledge of the Roman Catholics, at the same time the Reformers insisted on the absolute certainty of their own cause. But how could they justify the absolute truth of their own claims? Luther quite dogmatically insisted on the truth of his views.[62] What the Reformers claimed as divinely true was thus absolutely certain and obvious. Its certainty was not called into question. Therefore, there was no need for the choice or order of the *loci* to be explained. So far as Melanchthon was concerned, there was no doubt that they represented reality.

Dialectics as a chain of concord thus succinctly sums up the nature of Melanchthon's method. Melanchthon was not aiming to provide a philological exposition of classical theories of method. Nor was he promoting dialectics as an instrument for probable arguments. On the contrary, as a skill of teaching, he believed dialectics could provide the absolute certainty he needed in countering a problem which he believed was jeopardizing Luther's cause. Moreover, it was the means with which Lutherans could teach their views as orthodox. Melanchthon's method was in this sense a Lutheran one.

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[60] Melanchthon, Prefatory letter to the *Erotemata dialectics*, addressed to Johannes Camerarius (1547), *CR* 6:655: "Imo Dialectica opus est, non solum ut doctrina lucem habeat, sed etiam ut sit concordiae vinculum."

[61] For instance Q. Breen (as note 7), 208.

[62] R. H. Popkin, *The History of Scepticism from Erasmus to Spinoza*, Berkeley 1979, 1-17. For Luther's "dogmatic" attitude as modelled on St Paul, see M. U. Edwards Jr, *Luther and the False Brethren*, Stanford 1975.

In terms of achieving what it was designed for, Melanchton's method was quite successful. His method was followed by several Protestant thinkers, thereby becoming an important part of the Protestant philosophical tradition.[63] Melanchthon's natural philosophy which was also part of his reformed philosophy[64] became also part of that tradition, leaving marks on such men as Johannes Kepler, Clemens Timpler and Bartholomaeus Keckermann.[65] For a fair picture of sixteenth-century concepts of method, I thus believe it is necessary to include cases from North of the Alps. Melanchthon's concept of method may seem a far cry from the Paduan method which Randall studied. Yet, at the end of the century, Zabarella's logic found an audience in Protestant men such as Johann Ludwig Hawenreuther and Julius Pacius.[66] Further study will be needed to assess not only the kinds of method which served various philosophical enterprises, but also the extent of the cross-fertilization amongst different enterprises and traditions.[67]

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[63] For those in the Protestant tradition who followed Melanchthon, see Risse (as note 3), 107-21; P. Petersen, *Geschichte der Aristotelischen Philosophie im Protestantischen Deutschland*, Leipzig 1921, 109-218, and R. Kolb, *Luther's Heirs Define his Legacy: Studies in Lutheran Confessionalization*, Aldershot 1996.

[64] See Kusukawa (as note 55).

[65] For Kepler's debt to Melanchthonian rhetoric and dialectics, see N. Jardine, *The Birth of History and Philosophy of Science: Kepler's* A Defence of Tycho against Ursus, Cambridge 1984, 75-9; for Timpler, see J. S. Freedman, *European Academic Life in the Late Sixteenth and Early Seventeenth Centuries, The Life, Significance, and Philosophy of Clemens Timpler 1563/4-1624* (Studien und Materialen zur Geschichte der Philosophie 27), 2 vols, Hildesheim/Zurich/New York 1988; for Keckermann, see C. H. Lohr, *Latin Aristotle Commentaries: II: Renaissance Authors*, Florence 1988, 209-10.

[66] I. Backus, "The Teaching of Logic in two Protestant Academies at the End of the Sixteenth Century: The Reception of Zabarella at Strasbourg and Geneva," in: *Archiv für Reformationsgeschichte* 80 (1988), 240-51.

[67] I wish, however, to draw attention to the following important literature on Melanchthon's dialectics which has appeared since I completed this paper: K. Meerhof, "Logique et Création selon Philippe Melanchthon," in: M.-L. Demonet-Luanay and A. Turnon (eds.), *Logique et Littérature à la Renaissance: Actes Colloque de la Baume-les-Aix, Université de Provence, 16-18 septembere 1991*, Paris 1994, 51-68; P. Mack, *Renaissance Argument: Valla and Agricola in the Traditions of Rhetoric and Dialectic*, Leiden 1993, especially 320-33; Günter Frank, "Melanchthon's Dialektik und die Geschichte der Logik," in: J. Leonhardt (ed.), *Melanchthon und das Lehrbuch des 16. Jahrhunderts*, Rostock 1997, 125-45.

For Randall, originally writing in 1940, it was irrelevant to ask to what kind of a project method had to belong, for it seemed obvious that there was only one scientific, mathematical and experimental method. Fifty years on, the very idea of maintaining a clear-cut definition of a "scientific revolution" has become problematic.[68] The nature of the enterprises for which various methods were devised can no longer be regarded as monolithic.[69] Concepts of method, I believe, are thus best understood in terms of the enterprise for which they were designed, rather than for their "original" contribution to "modern science."[70] It is, therefore, the nature of those enterprises that we need to examine if we wish to understand what was happening to natural philosophy in the sixteenth century.

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[68] See for instance the essays in D. C. Lindberg and R. S. Westman (eds.), *Reappraisals of the Scientific Revolution*, Cambridge 1990.

[69] Zabarella himself was just as concerned with the proper office of philosophy, which had signficant moral implications, as he was with the concept of "regressus", see N. Jardine, "Keeping Order in the School of Padua," in this volume. I am grateful to Professor Jardine for letting me read an earlier draft of his paper. Cf. also the epideictic skills in Galileo, as treated in B. Vickers, "Epideictic Rhetoric in Galileo's *Dialogo*," in: *Annali dell'Istituto e museo di storia della scienza di firenze*, 8/2 (1983), 69-102.

[70] For the futility of attempting to gauge the "creativity" of sixteenth-century thinkers, see P. O. Kristeller, "'Creativity' and 'Tradition'," in: idem., *Renaissance Thought and the Arts: Collected Essays*, Princeton ^{2}1990, 247-58.

KEPLER'S EPISTEMOLOGY

Peter Barker

Kepler's first important work is the *Mysterium Cosmographicum* (1596).[1] Although Kepler rejected small parts of the *Mysterium* in later writings (for example the explanation of planetary motion by animating souls), he also regularly referred back to this work, suggesting in the notes added to the 1621 edition that almost everything of consequence in his later ideas was already present or foreshadowed in the *Mysterium.* In this paper I will sketch an answer to three connected questions: what was it about the *Mysterium* that made Kepler keep referring back to it, even bringing out a new edition in 1621, after he had completed his major works (bar the *Rudolphine Tables*)? This question in turn depends upon an answer to what moderns would call an epistemological question: why did Kepler believe that the results of the *Mysterium* were sound or certain? And the answer to this permits an answer to a third question: why do we find in the work of Kepler, and his immediate predecessor Tycho Brahe, the systematic comparison of cosmological positions through their astronomical implications?

Lutheran natural philosophy and the natural light

The sixteenth century was a period of eclecticism. Presented with new ideas, either from newly available ancient sources or from contemporary innovators, sixteenth-century thinkers often took what they wanted and discarded the rest. A prime example is the Wittenberg interpretation of the Copernican system, as described by Robert S. Westman. Between 1543 and the time of Kepler a group of Lutheran intellectuals, with Phillip Melanchthon as the central figure, took the mathematical techniques introduced by Copernicus in *De Revolutionibus* and adapted them to a geocentric system. Immediate fruits of this work were the *Prutenic Tables* of Erasmus Reinhold. Melanchthon himself praised Copernicus' theory of the moon, and used Copernican figures for planetary parameters in preference to the Ptolemaic ones.[2]

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[1] Johannes Kepler, *Mysterium Cosmographicum*, Tübingen 1596; 2nd ed. Frankfurt 1621. English tr.: A. M. Duncan, *Johannes Kepler: The Secret of the Universe*, New York 1981. French tr.: A. Segonds, *Jean Kepler: Le secret du monde*, Paris 1984.

What the Wittenberg school failed to do was to adopt Copernicus' cosmology. Indeed the claim that the Earth goes round the Sun attracts so little attention from the Wittenberg school that the silence is puzzling to a modern audience brought up to believe that Copernicus was a radical innovator, and that heliocentrism was his radical innovation.

Wittenberg astronomers did not devote much attention to Copernican cosmology, because it was obviously wrong. It was obviously wrong because the principles of physics were well understood, and in the conventional order of the sciences—a scheme that even Copernicus endorsed—astronomy was firmly subordinated to physics. From an epistemological viewpoint, seriously entertaining, let alone adopting, Copernican cosmology required the abandonment of a whole corpus of settled knowledge. In the Aristotelian order of the sciences, each science owed its ultimate principles to the next superior science in the hierarchy. Astronomy depended upon mathematics, and to the extent that it treated causes, on physics. Here however a difficulty arose in astronomy as compared to other mixed sciences.[3]

The standard technique for establishing causes was a complex process of reasoning sometimes called *regressus*, but also passing under a variety of other names that identified parts of the whole. The most conspicuous parts may be described as a double motion of ascent to causes and redescent to phenomena. The first step was reasoning from the effects to a possible cause (reasoning *quia*; or *a posteriori*). By examining this possible cause and other similar causes, the second step in the epistemological chain then established a particular cause as the unique cause of the phenomena from which the inquiry began. With this cause established, and a written statement of it deployed as a principle, it was possible, as a third and final step, to rederive a description of the initial phenomenon by deduction (reasoning *propter quid*, or *a priori*). Ideally, any study of natural things should go through all three of these steps.[4]

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[2] R. S. Westman, "The Melanchthon Circle, Rheticus and the Wittenberg interpretation of the Copernican theory," in: *Isis* 66 (1975) 165-93. For Melanchthon's remarks on Copernicus see Philip Melanchthon, *Corpus Reformatorum, Philippi Melanchthonis opera, quae supersdunt omnia*, 28 vols., Halle 1834-60, reprinted: New York 1963 (hereafter *CR*) 13:244 (Moon model praised), 13:262 (Copernicus' apogees of superior planets preferable to Ptolemy's).

[3] J. A. Weisheipl, "Classification of sciences in medieval thought," in: idem, *Nature and Motion in the Middle Ages*, Washington 1985, 203-37. Roger Ariew, "Descartes and the tree of knowledge," in: *Synthese*, 92 (1992), 101-16. Copernicus gives a canonical list of middle sciences in the first paragraph of the MSS of *De Revolutionibus*, but the passage is deleted from the first printed version.

A special difficulty obtruded in the case of astronomy: while it was possible to make the inductive ascent from the phenomena (most importantly measurements of the positions of the planets) to various *possible* causes (for example homocentric orbs, eccentric or epicyclic orbs, or some combination), there seemed to be no way of establishing that one among the possibilities was the sole and actual cause of the planetary motions. The reason was quite simply that terrestrial observers lacked direct access to the heavens, (a limitation that both Maestlin and Kepler admitted).[5] An observer in another mixed science like optics could manipulate apparatus, or examine the optical system in greater detail to establish that a particular cause was the unique cause of a phenomenon under study. Astronomers were prevented from getting closer to their objects of study or finding out more—except perhaps in the afterlife—a limitation on astronomy that had been recognized since antiquity.

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[4] For Kepler's understanding of his own work as reasoning a priori, as opposed to the customary a posteriori reasoning found in astronomy, see especially, *Mysterium* (as note 1), Ch. 1.
On regressus see H. Mikkeli, *An Aristotelian Response to Renaissance Humanism: Jacopo Zabarella on the Nature of the Arts and Sciences*, Helsinki 1992; W. A. Wallace, *Galileo's Logic of Discovery and Proof. The Background, Content, and Use of His Appropriated Treatises on Aristotle's Posterior Analytics* (Boston Studies in the Philosophy of Science 137), Dordrecht/ Boston 1992. This is the companion volume to: W. A. Wallace, *Galileo's Logical Treatises. A Translation, with Notes and Commentary of His Appropriated Latin Questions on Aristotle's Posterior Analytics* (Boston Studies in the Philosophy of Science 138), Dordrecht/Boston 1992, which in turn translates Galileo Galilei, *Tractatio De Praecognitionibus et Praecognitis and Tractatio De Demonstratione*, transcribed from the Latin autograph by W. F. Edwards, introduction, notes, and commentary by W. A. Wallace, Padova 1988.

[5] Michael Maestlin, *De astronomiae hypothesibus*, Heidelberg 1582, Thesis 1, fol. A2^r; Kepler, *Apologia Pro Tychone Contra Ursum*, unpublished MS (ca. 1600). English tr.: N. Jardine, *The Birth of History and Philosophy of Science*, Cambridge ^{2}1988, especially 144.

In the case of planetary motion, astronomy was therefore restricted to the *a posteriori* side of the demonstration. No *a priori* proofs were available. And, given the absence of *a priori* proofs, the claims of astronomy had to be judged inferior to those of other sciences. From this viewpoint, the main difference separating Copernicus, sixteenth-century Copernicans like Rheticus and Rothmann, and Kepler from their predecessors in the astronomical tradition is that the Copernicans' belief that they could provide *a priori* proofs where none had been available in traditional astronomy. Kepler, at least, saw his program from the outset in just these terms. Kepler however was in a position to provide certain principles for *a priori* demonstrations in astronomy from a source unavailable to Copernicus, and thereby to circumvent the need for the first and second stages in the process of *regressus*. The source of these principles, and Kepler's confidence in them, may be sought in the recent history of his confessional faith, Lutheranism.

Returning to astronomy, the statements by sixteenth-century natural philosophers that astronomy was confined to *a posteriori* proofs has sometimes been represented by twentieth-century historians as an endorsement of instrumentalism, or as an expression of general scepticism about the status of knowledge in natural philosophy. As a matter of fact there was no general denial of the possibility of knowledge of nature among Lutherans. For an authoritative statement we need look no further than Melanchthon, who points to three sources of certain knowledge of nature: innate, or inborn, knowledge; experience; and deductions from such knowledge.[6] The first of these kinds of knowledge plays a special role in Kepler's early epistemology.

For Melanchthon, the most important form of innate knowledge is knowledge of the *leges naturae*. The simplest translation of this phrase is "laws of nature" but this should not be confused with the modern meaning. For Melanchthon, "laws of nature" are moral principles, and not knowledge of nature. They are the source of our knowledge that obedience to civil authority is right; and that many obvious forms of civil disorder, mayhem and brigandage are wrong. These principles were placed in the soul by God at its creation.[7] Now of course not all of us recognize the legitimacy of the civil authorities, or abstain from brigandage. These moral principles do not assert themselves; rather we gain access to them through a faculty of the mind called the natural light.

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[6] Philip Melanchthon, *Initia Doctrinae Physicae* 1549, *CR* 13:150; *Erotemata Dialectices* 1547, *CR* 13:647.

[7] Melanchthon, *Loci Communes* (1521), tr. L. J. Satre and W. Pauck (Library of Christian Classics, 19), Philadephia 1969, 50: "The law of nature, therefore, is a

The doctrine of natural light as the means of access to innate knowledge is at least as old as Augustine,[8] and was accepted by Melanchthon before he ever became a Lutheran.[9] However the doctrine assumed a new importance when it was deployed by Melanchthon during the Magisterial Reform of Lutheranism, in the wake of the 1525 peasant uprisings in Germany. The doctrine of natural law—in the moral sense—and the correlative doctrine of natural light were key elements in Melanchthon's dissociation of Lutheranism from the enthusiasts (especially Anabaptists) who had taken part in the uprisings. Lutherans were supposed to employ the natural light to come to know that obedience to the civil authorities was right, and the violence of the rebelling peasants was wrong. Historically, the manoeuvres of Luther and Melanchthon during the Magisterial reform ensured the alignment of Lutheranism with the temporal powers in Germany. Intellectually, the extensive use of the doctrines of natural law and natural light provided resources that were readily deployed outside moral principles, especially in the case of mathematics, which had long been considered a paradigm of certain knowledge.[10]

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common judgement to which all men give the same consent. This law which God has engraved on the mind of each is suitable for the shaping of morals. For just as there are certain common principles in the theoretical branches of learning, in mathematics for instance (they might be called 'common thoughts' or 'a priori principles', such as 'The whole is greater than its parts'), so there are certain common axioms and a priori principles in the realm of morals: these constitute the ground rules for human activity. (We must use these terms for pedagogical reasons.) These rules for human activity are rightly called 'laws of nature'."

[8] The Stoic origins of the doctrine are acknowledged by Melanchthon, *Erotemata Dialectices* 1547, *CR* 13:647. See also N. Jardine "The forging of modern realism: Clavius and Kepler against the sceptics" in: *Studies in History and Philosophy of Science* 10 (1979) 150-1, and idem, *The Birth of the History and Philosophy of Science* (as note 5), 240.

[9] See the discussion of *De artibus liberalibus oratio Philippo Melanchthone Tubingae anno 1517*, in J. R. Schneider, *Philip Melanchthon's Rhetorical Construal of Biblical Authority*, Lewiston, N.Y 1990, 38-43.

[10] On the natural light doctrine see G. Cifoletti, "Kepler's *De Quantitatibus*," in: *Annals of Science*, 43 (1986) 213-38, especially 217-9. On Melanchthon's use of the natural law doctrine during the Magisterial Reform see S. Kusukawa, *The*

Kepler introduces the doctrine of natural light in the case of mathematics. In a fragmentary work entitled *De Quantitatibus*, he tells us:

> ...[T]here are, as I began to say above not a few more special principles of mathematics, which are understood be means of the common light of nature, do not need demonstration and are at first associated with quantities, and then are applied to other things, insofar as they share something with quantities. Of those principles there are more in mathematics than in other contemplative sciences, because of the very nature of human understanding itself, which seems to be such, by the law of creation, that it cannot know anything perfectly except quantities or by means of quantities. This is why it is the case that the conclusions of mathematics are the most certain and unquestioned.[11]

Similarly, near the beginning of the *Apologia pro Tychone contra Ursum* we are told that geometers rested the certainty of their conclusions on the natural light before the historical development of logic:

> The first use of the word [hypothesis] was by geometers. Before the birth of logic as a part of philosophy, when they wanted to expound their demonstrations by the natural light of the mind, they used to start their demonstration from some established beginning. ... Those things that were certain and acknowledged by all, they used, therefore, to call by the special name "axioms", that is to say opinions that had authority with all.[12]

Dating *De Quantitatibus*

The *Apologia*, we know, was written around Christmas 1600, just after Kepler's move to Prague and while Tycho Brahe was still alive. The

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Transformation of Natural Philosophy: the Case of Philip Melanchthon. Cambridge 1995, 62-74.

[11] Kepler, *De Quantitatibus*, in C. Frisch, *Johannis Kepleri astronomi Opera Omnia*, 8 vols., Frankfurt am Main 1658-71 (hereafter *Opera Omnia*), 8:148, tr. G. Cifoletti (as note 10), 224: "Sunt vero, ut supra dicere coepi, principia quaedam mathematicorum specialiora non pauca, quae communi lumine naturae cernuntur nec demonstratione indigent quaeque primario de quantitatibus sonant, post rebus aliis adhibentur, quatenus communicant illae nonnihil quantitatibus. Et horum pricipiorum plura sunt in mathematica, quam in aliis contemplationis scientiis, propter ipsam intellectus humani naturam, quae videntur talis esse lege creationis, ut nihil nisi aut quantitates, aut per quantitates perfecte cognoscere possit. Itaque sit, ut certissimae et indubititae sint mathematicorum conclusiones."

[12] Kepler, *Apologia pro Tychone contra Ursum*, fol. 265v, tr. Jardine (as note 5), 137: "Prima vocis usurpatio fuit apud Geometras: qui ante natam logicam philosophiae partem, naturali mentis lumine demonstrationes suas geometricas cum vellent expedire, soliti sunt a certo quodam initio doctrinam incipere. ... Quae itaque certa et apud homines confessa essent, ea speciali nomine AXIOMATA dictitarunt, ceu sententias dicerent, quae haberent authoritatem apud omnes."

dating of *De Quantitatibus* is somewhat uncertain. Frisch, the editor of the first edition of Kepler's works, suggested that it was the "diatyposis" referred to in correspondence between Kepler and Matthias Bernegger of Strasbourg, in spring 1629. Bernegger had written to Kepler asking him to produce an introductory work on mathematics for students at Strasbourg's Calvinist college. This would replace the text then in use, by Konrad Dasypodius, an earlier teacher at Strassbourg, who had died in 1600. In reply, Kepler said that he thought Dasypodius' book was still useful, and that he had written a preface in the form of a diatyposis to "show the relative connection of things that are dispersed in [Dasypodius'] text." Frisch thought this was the *De Quantitatibus*, making it a late work, written after all Kepler's important works had been published, and well after the second edition of the *Mysterium* in 1621. Cifoletti, the author of a recent translation, suggests that the work should be given a much earlier date, before much of Kepler's major work and perhaps immediately after he left Tübingen. Cifoletti, however, continues to accept Frisch's suggestion that it is the introduction to Dasypodius referred to in the correspondence with Bernegger, despite the general disparity between the content of the *De Quantitatibus* and that of Dasypodius' text. I believe that both the dating and the identification offered by Frisch are incorrect. Cifoletti is generally correct about the date, but the *De Quantitatibus* cannot be the work referred to in the correspondence with Bernegger.[13]

A first point against Frisch's identification of the work, and hence the late date, is that the work is simply not a "diatyposis". I take it that a "diatyposis" is the presentation of a subject matter according to binary divisions, often summarized in a branching diagram, popularized by Ramus and his followers, and endemic in texts and marginalia by Kepler's day. An example of such a chart precedes the *Astronomia Nova.* For something to count as a diatyposis, however, I take it the subject matter must be presented in paired categories that are subdivided into paired categories. The *De Quantitatibus* does not fit this pattern, and consequently cannot be the work referred to in the correspondence with Bernegger.

A curious piece of evidence, noted by Cifoletti, is a reference to Schegk (Jacob Degen, 1511-87), a relatively obscure professor of natural philosophy who taught at the Lutheran university of Tübingen for many years immediately before Kepler became a student there. Cifoletti sees the reference as relevant to establishing the date but not the identification of the work. It is certainly plausible that Kepler would know of Schegk's commentaries on Aristotle, and perhaps refer to him as an authority, in something written just after leaving the Tübingen milieu. Cifoletti sees Kepler's reference to Schegk as suggesting an early date of composition (which he does not further specify), but he fails to see that the positive tone of the reference to Schegk—an Artistotelian—is evidence against the identification of the *De Quantitatibus* as an introduction to Dasypodius. "Kepler," he tells us, "thought of *De Quantitatibus* as an introduction to Dasypodius' textbook, but by choosing the Aristotelian context, he distances himself from the tradition to which Dasypodius belonged. Dasypodius' works on mathematics, like Ramus', were within the genre developed after the rediscovery of Proclus' commentary on Euclid. Instead, Kepler took a position following the Aristotelian humanism of Schegk."[14] Interest in Schegk declined swiftly after his death: his books were not reprinted after 1585.[15] Contra Frisch's proposed date, it seems unlikely that Kepler would refer to Schegk in an introductory work intended for Calvinists and written perhaps in the late 1620s. This is quite apart from the matter of Proclus.

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[13] *Opera Omnia*, 8:145-61, trans Cifoletti (as note 10), 213-38.

Kepler's (almost) lifelong admiration of Proclus makes it implausible to suggest that he could have omitted reference to Proclus, or taken an opposing Aristotelian position, in a work written or circulated in 1629, near the end of his life. This is particularly telling against Frisch's identification of the *De Quantitatibus* with a preface to Dasypodius written at the end of Kepler's career. Kepler's mature works are full of Proclan doctrines, and substantial quotations from his works on mathematics.[16] Secondly, if Crapulli is correct, Dasypodius himself was an exponent of Proclus' doctrine of *mathesis universalis*, and, as Cifolletti notes, Dasypodius' writings should be seen in the context of the revival of interest in Proclan themes which took place during the sixteenth century.[17] Kepler could, therefore, hardly have avoided mentioning Proclus in a preface to a work by Dasypodius written late in his own life. We know, however, that Kepler probably did not read Proclus' most relevant mathematical work, a commentary on the first book of Euclid's *Elements*, until 1599, or shortly before.[18] He immediately began to speak of Proclus in the most complimentary terms. Kepler's earliest reference to Proclus' book on Euclid therefore gives us a plausible latest date for the composition of the *De Quantitatibus*.

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[14] Compare Cifoletti (as note 10), Summary, 213, and 220.

[15] C. H. Lohr, "Renaissance Latin Aristotle Commentaries, Authors Pi-Sm," in: *Renaissance Quarterly*, 33 (1980) 718-20. The latest editions of Schegk's works shown by Lohr are editions of *Commentaria in VIII libros Topicorum Aristotelis*, appearing at Tübingen and Lyons in 1585.

[16] See for example the quotations with which Kepler begins the first and fourth books of the *Harmonices Mundi* (Linz 1619), and the long quotation 114-7, E. J. Aiton, A. M. Duncan and J. V. Field (eds. and trs.), *The Harmony of the World by Johannes Kepler* (Memoirs of the American Philosophical Society 219), Philadelphia 1997, 298-302.

The earliest date of composition may be inferred from another piece of internal evidence. In the notes to the 1621 edition of the *Mysterium*, one of the doctrines Kepler rejects from the 1596 edition is the claim that anything capable of being counted (numbered) is material, and the version of this doctrine that appears in the *De Quantitatibus* is the later version, agreeing with the 1621 edition of the *Mysterium*. Hence the work must have been composed after 1596.[19]

Frisch and Cifoletti are committed to some or all of the following claims: that the *De Quantitatibus* is a diatyposis; that it intended as a preface to a work in the tradition of Proclus, that the Kepler himself is an admirer of Proclus, and that despite all this, Proclus is nowhere mentioned in the work; and (at least in the case of Frisch's proposed date of c.1629) that Kepler here presents an Aristotelian view of mathematics, quite different from the view he held himself. However, the work is not a diatyposis. There is no other indication that Kepler abandoned his mature—Proclan—view of mathematics in favor of Aristotelianism, or that assuming an Aristotelian stance would be pedagogically appropriate in the case of Dasypodius' work. All these difficulties disappear if the composition of *De Quantitatibus* is dated to the period after Kepler encountered Schegk's work at Tübingen, but before he read Proclus on the first book of Euclid. For all these reasons, then, I conclude that the *De Quantitatibus* is an early work, most likely composed between 1596 and

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[17] On Dasypodius see G. Crapulli, *Mathesis Universalis*, Rome 1969, 63-91.

[18] The first indication that Kepler has read the book appears in a letter to Hewart von Hohenberg, in September 1599, *Opera Omnia*, 5:20-1.

[19] Kepler, *Mysterium*, 1596 (as note 1), Ch. 12; repudiated in note (2) of the *Mysterium* 1621. However, the corrected doctrine also appears in *De Quantitatibus*, Ch. 5, Cifoletti (as note 10) 228.

1599, prior to the *Apologia*, and that his remarks on the light of nature shows us Kepler's views on the origin of mathematical certainty, at least early in his career.

Providence and cosmology

In Kepler the Lutheran revival of the natural light doctrine combines with a second Lutheran theological idea to provide a license for what we would now call cosmological theorizing. This second doctrine is the Lutheran idea of Providence, or God's plan for the ordering and governance of the universe, understood causally. As Kusukawa has shown, the Lutheran concept of Providence played an important role in Melanchthon's rehabilitation of natural philosophy, and especially in the emphasis placed on astronomy and astrology at Lutheran universities. Lutherans regularly conjoined descriptions of the construction of the world with the theme of God's providence. Central to these ideas were versions of the argument from design, especially the idea that the universe was benevolently designed for the benefit of the human race, and, that this structure as a whole displayed evidence of the activity of a mind that had constructed it.[20]

It is not surprising, therefore, that the concept of providence played a role in controversies about cosmology. Kusukawa suggests, for example, that this was a major element in the Lutheran appraisal of Copernicus. Displacing the Earth from the center of the universe would have the effect of dislocating the providential design, including the arrangement of the heavens to reveal matters to those on earth, and the influence of the heavens on the earth.[21] Similarly, one of Tycho Brahe's reasons for rejecting Copernicanism was the "wasted space" that would extend from the sphere of Saturn to the sphere of the fixed stars in any heliocentric universe large enough to explain his failure to observe stellar parallax. Tycho's complaint does not appeal to a principle of economy or simplicity, but in the first instance should be read as a statement, made with the confidence of a Lutheran, that elements in human cosmic designs that fail to contribute to the workings of divine Providence do not belong.

Kepler also explicitly connects the insights presented in the *Mysterium* with God's providential design of the world. The "Greetings to the Reader" that precedes the dedication introduces the book's contents as: "The nature of the universe, God's motive and plan for creating it ..."[22] The Preface begins by repeating this motif, and the three central questions to be answered should also be understood as questions about Providential design: "There were three [questions] in particular about which I persistently sought the reasons why they were such and not otherwise: the number, size and motion of the orbs."[23]

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[20] Kusukawa (as note 10) 124-73.

[21] Ibid., 171-2.

If the *Mysterium* is read exclusively as a contribution to astronomy, it is difficult to understand the motivation for these three questions. Let us consider them in reverse order. The motion of the orbs is a traditional astronomical concern. Their sizes are a different matter. It is sometimes argued in favor of Copernicus and against Ptolemy that the dimensions of the Ptolemaic system are arbitrary. In fact there was a well established system for calculating the dimensions of the celestial orbs in the Ptolemaic system, although not all the principles it employed were strictly astronomical.[24] However, the question with which Kepler begins, and which presumably leads naturally to the other two, is not usually addressed in astronomy. This is the question of the number of the orbs, or as Kepler rapidly makes clear, why there are six planets and not some other number.

Writing in 1624, Marin Mersenne asserts:

> It is impossible that there would be the *number* of planets and stars such as there is, and that the heavens could keep the *distance* between them, if there were not someone who has given them these proportions and who has made them in this number, rather than another. (trans, Roger Ariew, emphasis added)

Mersenne's assertion appears in a proof of the existence of God, in a work attacking atheism "using reasons derived from philosophy and theology."[25] Mersenne makes an unequivocal connection between Kepler's research questions, the existence God, and the Providential design of the universe. Similarly Kepler invites us to read the *Mysterium* not as a contribution to astronomy but as a revelation of God's Providential plan of the world. The research questions that motivated the *Mysterium* are primarily questions about the ordering of God's providence, and secondarily about astronomy.

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[22] Kepler, *Mysterium* (1621) *Lector Amice Salve*, tr. Duncan (as note 1), 49: "Quid mundu, quae causa Deo, ratioque creandi, ..."

[23] Kepler *Mysterium* (1621), *Praefatio antiqua*, 7, tr. Duncan (as note 1) 63: "Et tria potissimum erant, quorum ego causas, cur ita, non aliter essent, pertinaciter quaerebam, Numerus, Quantitas, et Motus Orbium."

[24] A. Van Helden, *Measuring the Universe*, Chicago, 1985.

[25] Marin Mersenne, *L'impieté des deistes, athees, et libertins de ce temps, combatuë, et renversee de point en point par raisons tirees de la Philosophie, & de la Theologie*. Paris, 1624, 96: Chap. 5, reason 6, tr. by R. Ariew, in: R. Ariew, J. Cottingham and T. Sorell (eds.), *Texts in Context: Descartes' Meditations*. Cambridge, forthcoming: "Il est impossible qu'il y ait un tel nombre de Planettes,

Perhaps the clearest statement of Kepler's position appears in Chapter IV of the Mysterium, where Kepler writes:

> ... I think that from the love of God for man a great many of the causes of the features in the universe can be deduced. Certainly at least nobody will deny that in fitting out the dwelling place of the universe God considered its future inhabitant [i.e. Man] again and again. For the end both of the whole creation and of the universe is Man.[26]

Kepler's application of the providence doctrine is unusual. Usually what is deduced is the existence of God, and it is God's providential arrangement of the causal structure of the world that constitutes the evidence. For Kepler, however, the ultimate causes are geometrical archetypes, and these may be understood with certainty through the operation of the natural light. If God is a geometer, then his geometrical plan for the universe may also be understood with certainty by the same means. As we have seen, Kepler's early assurance about the certainty of geometry rested on the natural light doctrine. His lifelong adherence to a view that placed archetypes at the center of knowledge should be seen against this background. He could not abandon the archetypes without abandoning the claim to certainty at the foundations of his system.

In Kepler the Lutheran vision of natural philosophy as the knowledge of God's providence, and the revived doctrine of natural light, combine to provide the foundations for his lifelong research program. While the natural light originally validated the certainty of his work, its status within the Lutheran ideal of understanding Divine Providence was no less important. Kepler thought he had been granted a unique insight into

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et d'estoilles, comme il y a, et que les Cieux puissent garder la distance qui se trouve des uns aux autres, s'il n'y a quelqu'un qui leur ait donné ces proportions, & qui les ait fait en ce nombre, plustost qu'en un autre;..." I am grateful to Roger Ariew for drawing may attention to this and other sources for the doctrines discussed in this paper.

[26] Kepler, *Mysterium* (1621), Chap. 4, 29, tr. Duncan (as note 1), 107: "Etenin existimo ex amore Dei in hominem causas rerum in mundo plurimas deduci posse. Certe equidem nemo negabit, in domicilio mundi exornando Deum ad incolam futurum identidem respexisse. Finis enim & mundi & omnis creationis homo est."

God's providential plan. He wrote it down in the *Mysterium*. The remainder of his career was for Kepler a working out of the details within this unitary vision, hence the persistent importance of the ideas presented in the *Mysterium* in all Kepler's later work. Kepler could not reject the providential plan revealed in the *Mysterium* without rejecting his own license to work on astronomy and natural philosophy.

To a modern thinker the act of juxtaposing and choosing among world systems seems natural. We are presented with what we see as a clear choice between the systems of Copernicus, Tycho Brahe and Ptolemy. Sixteenth-century thinkers did not see themselves as compelled to choose among a series of exclusive options, at least not when they confined their attention to natural philosophy.[27] Before a choice could be made, it was first necessary to see that a choice was necessary, and indeed possible. In theology, however, there could be only one right answer. To the extent that the structure of the world was seen as a theological issue—defined by God's providential plan—the appearance of alternative accounts would compel a choice. Kepler seems to be comparing the theories of Ptolemy, Copernicus, and Tycho Brahe in his later works. However, underlying this apparently modern activity is a Lutheran confidence that individuals are capable of comprehending God's providential design of the world, and that this design is unitary.

Neither of the main themes I have discussed in this paper, the natural light doctrine and the concern with the world's Providential design, are the sole concern of Kepler, or indeed the Lutherans. Arguments for the existence of God based on the providential design of the world are common in Aristotelian texts throughout the period,[28] and readily employed by Catholics like Mersenne as well as Lutherans like Kepler. The later fortunes of the concept of providence have been studied recently by Funkenstein, and by Margaret Osler.[29] Similarly the natural light doctrine has a long history on both sides of the confessional division, and achieves new prominence in the work of Descartes. In recognising the importance of these doctrines to Kepler my aim is not to advance new claims for Kepler's originality, but to help us see the man and his work in the setting of his times. The claims to originality that survive contextualisation are the only ones we should take seriously.[30]

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[27] On eclecticism in early modern natural philosophy see Peter Barker, "Stoic contributions to early modern science," in: M. J. Osler (ed.), *Atoms, pneuma and Tranquillity*, Cambridge 1991, 135-54.

[28] See for example the extremely popular exposition of traditional philosophy by Scipion DuPleix, *La Physique* (Paris 1603), especially Ch. 3 & Ch. 12. New edition: R. Ariew (ed.), Paris 1990.

[29] A. Funkenstein, *Theology and the Scientific Imagination*, Princeton 1986, especially Ch. IV; M. J. Osler, *Divine Will and the Mechanical Philosophy: Gassendi and Descartes on Contingency and Necessity in the Created World*, Cambridge 1994.

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LATIN ARISTOTELIANISM AND THE SEVENTEENTH-CENTURY CALVINIST THEORY OF SCIENTIFIC METHOD

Charles H. Lohr

The works of Aristotle were made available in the Latin West in three clearly distinguishable stages. The first stage opened in the sixth century with Boethius' translations of Aristotle's treatises on logic. The second stage began in the twelfth century with the gradual translation—at first from Arabic, and later from Greek—of the entire corpus of Aristotle's works. In this "scholastic" stage the attempt was made to bring together Latin theology and Aristotelian science, an effort which was strongly influenced by Islamic philosophy. The third and final stage in the evolution of Latin Aristotelianism began in the fifteenth century and concentrated rather on the original text of Aristotle's works and on dealing with the anomalies which were making the traditional conception increasingly untenable.[1]

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The first wave of translations broke on the late Roman world. This world knew little of Greek philosophy and science, and apart from some rhetorical notions transmitted by Cicero, very little of Aristotle. Boethius' translations of the *Organon* could have but little effect in the monastic life of the early Middle Ages, where the conception of language as a divine creation—directly opposed to Aristotle's theory—gounded a symbolic view of the world.

In the second stage Aristotle's works were received as part of a vast effort to absorb the secular learning not only of ancient Greece, but also of contemporary Judaism and Islam. In the flourishing young towns of the western Mediterranean basin, scholars manifested increasing interest in the great works of Greek and Arabic science and in the Aristotelian encyclopaedia which provided the framework for them.

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[1] C. H. Lohr, "Metaphysics," in: C. B. Schmitt, E. Kessler and Q. Skinner (eds.), *The Cambridge History of Renaissance Philosophy*, Cambridge 1988, 537-638.

Characteristic of medieval scholasticism was the desire to bring this new material together with theological teaching and the traditional liberal arts in one comprehensive body of knowledge. In the search for models for the ever more pressing problem of the systematic presentation of doctrine, the masters were first guided by Boethius and then by Euclid. Boethius had understood science in the Aristotelian sense of doctrine which takes its departure from first principles and proceeds to certain conclusions by strict demonstration. Writers like Gilbert of Poitiers sought to systematize all the sciences on this model. Acquaintance with Euclid toward the end of the century led some to take his axiomatic method as a still better model for the systematic presentation of a traditional body of knowledge. Efforts were made by authors like Nicholas of Amiens to develop theological doctrine accordingly.

Working in the tradition of the *concordia discordantium*, thirteenth-century teachers attempted to situate theological teaching within the Aristotelian classification of the sciences, as it was known through the works of Boethius and the Muslim philosopher, Alfarabi, and to present the whole scientifically in Aristotle's sense.

Thus the attention of the masters was turned to the need for a concept of science which could more readily embrace both revealed doctrine and philosophical learning. About the beginning of the thirteenth century, since Aristotle's logic was explicitly excluded from the condemnations of 1210 and 1215, the masters turned their attention increasingly to the theory of science elaborated in the *Posterior Analytics*. While the masters of arts worked on the axiomatic presentation of the quadrivial sciences of geometry (including optics), astronomy, arithmetic, and music, the theologians sought to construct their science on the articles of faith as unproved but certain axioms or postulates, evident through revelation.

Both the theologians and the philosophers saw in Aristotle the "maestro e duca de la ragione umana' (Dante, *Convivio*). The newly translated commentaries of Averroes served to establish the understanding of the works of the Philosopher—"il maestro di color che sanno" (Dante, *Inferno*)—as a deductive presentation of philosophical truth. In accordance with this view the theologians sought to establish a *concordia* between Aristotle's conclusions and revealed doctrine.

Such an agreement had become increasingly important with the expansion of Western Europe towards the East. The Latin faith had to be presented to Saracens and Jews, and to the pagan Mongols who had recently invaded the Near East. While Christian doctrines could not be proved, their acceptance was thought to be able to be shown at least reasonable, because congruent with basic philosophical conclusions, like the existence of God and the immortality of the human soul, which Aristotle was thought to have demonstrated.

In the view of Thomas Aquinas the explanation of theological doctrine had to be in accord with Aristotle's theory of the speculative sciences. Through Aristotle's theory the theologians could maintain the scientific character of their discipline, while recognizing the autonomy of the philosophical sciences. Just as these sciences have their own principles, so also theology is the particular science which has the articles of faith as its proper principles. The Aristotelian metaphysics supplies the common principles for all the sciences and can thus guarantee those basic philosophical doctrines which support revealed doctrine. According to the metaphysical principle of contradiction philosophical doctrines which entail consequences contrary to revelation must be rejected.[2]

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The Aristotelianism of the third period we have distinguished—the period from 1450 to 1650—presents a picture which differs radically from the university philosophy of the Middle Ages. The revolt against scholasticism which took place during this period was basically part of a struggle between the old, established clerical class and new lay attitudes to philosophy.

Scholastic Aristotelianism had offered a hierarchically unified world-view, but by the sixteenth century this unity had broken down, so that we must speak in this period not of one, but of several Aristotelianisms. At the same time, Aristotelianism became in the Renaissance but one among many philosophies. Whereas in the earlier period Aristotle had been "the

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[2] C. H. Lohr, "Mittelalterliche Theologien," in: P. Eicher (ed.), *Neues Handbuch theologischer Grundbegriffe*, Munich 1991, vol. 3, 383-99.

Philosopher" par excellence, from the mid-fifteenth-century other philosophies—Platonism, Stoicism, Epicureanism—began to claim attention.

The period was nourished by a third stage in the Latin reception of Aristotle's works. Encouraged by the Byzantine thinkers who brought to Italy an Aristotle unknown to the scholastics, an Aristotle without Averroes, Latin scholars in the different countries of Western Europe produced new editions of the Greek text, new Latin and vernacular translations and commentaries, Greek editions and Latin translations of practically the whole corpus of the ancient Greek commentaries, and Latin versions of hitherto untranslated commentaries of Averroes. It is an astonishing fact that the number of Latin commentaries of Aristotle composed during the century between Pietro Pomponazzi[3] and Galileo[4] exceeds that of the entire millennium from Boethius to Pomponazzi.

In the sixteenth century new classes of students and new scientific interests led various groups of scholars to attend to individual works of Aristotle without reference to his organization of science. In the Renaissance the true Aristotelian spirit of pluralism and free research led to the disintegration of the hierarchical world-view of the Middle Ages.

The steps toward scientific pluralism were taken above all in Italy. Italian faculties of arts were orientated less towards theology than to medicine. Throughout the sixteenth century the Aristotelianism they taught was concerned primarily with the works of physical science and biology. In Italy also, humanist scholars turned to Aristotle's moral philosophy, literary critics to the teachings of the *Poetics*, professional philosophers in the universities to the natural philosophy and the biological works.

In Protestant Germany Philipp Melanchthon constructed a new secular Aristotelianism for the schools which should serve the Reformation.[5] In France and later in England the Ramist furore turned the attention of Aristotelians to questions of methodology,[6] while scholars concerned with constitutional reform returned to the Greek text of

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[3] C. H. Lohr, *Latin Aristotle Commentaries: II. Renaissance Authors*, Florence 1988, 347-62.

[4] Ibid., 157-61.

[5] Ibid., 254-8.

[6] Ibid., 374-6.

Aristotle's logic for new ways to interpret legal doctrine. Throughout Europe the *Politics* received renewed attention, quite without reference to the other parts of Aristotle's corpus.

At the same time much attention was paid, particularly in Italy, to the question of scientific methodology. Whereas the scholastic tradition, following Averroes, had concentrated on the deductive side of Aristotle's theory of science, Italian secular Aristotelianism not only rediscovered the equally Aristotelian method of induction, but also distinguished between scientific "methods" which lead to new knowledge and "orders" of presentation in the teaching of knowledge which has already been gained by men. Towards the end of the sixteenth century, Jacopo Zabarella, professor of logic and natural philosophy in Padua, distinguished clearly between the two moments, relating them to Aristotle's division of the theoretical and practical sciences. Whereas the theoretical sciences use a synthetic order in the presentation of doctrine, drawing conclusions from first principles, the practical sciences employ an analytic order which takes its departure from the end of an action and seeks to discover the means and principles with which the end may be attained.[7]

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The publication at Basel in 1594 of Zabarella's *Opera logica* made this distinction important for German theologians. In Lutheran dogmatics the analytic order became the standard approach with the publication in 1619 of Georg Calixt's *Epitome theologiae*.[8] Calixt was a pupil of Cornelius Martini[9] and professor of theology at Helmstedt, but the method was adopted at Jena and Wittenberg as well.

Applied to theology, the analytic order would present eternal beatitude, for example, as the end to be achieved, soteriology as the means to the end, Christology as its principle and the doctrine of man and creation as concerning the subject by whom the end is to be attained. Whereas philosophical theology, which has the apologetic function of demonstrating God's existence and human immortality, employs the synthetic order, the practical science of revealed theology proceeds analytically from ends to means and principles.

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[7] Ibid., 497-503.

[8] F. Lau, in: *Die Religion in Geschichte und Gegenwart* vol. 1 (Tübingen 1957) 1586-7.

[9] C. H. Lohr, *Latin Aristotle Commentaries: II* (as note 3), 247.

Calixt regarded philosophy as the condition for the scientific development of revealed theology. In accordance with the apologetic tendency which had appeared in seventeenth-century Lutheranism, he sought to develop rational proofs for the truth of the Christian religion, assigning to philosophy the task of proving not only the existence and attributes of God and the immortality of the soul, but also the necessity of revelation on the basis of God's providential care for human beings. This understanding of the relationship between philosophy and theology opened the way for the free development in Lutheranism of natural theology as a theoretical science, distinct from the practical science of revealed theology.

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The analytic order had little success in those German territories—the Palatinate, Nassau, Hesse-Kassel and several smaller principalities bordering on the Netherlands—which leaned towards Calvinism. In accordance with the architectonic spirit of Calvinist scholasticism, Reformed theologians at the universities of Heidelberg and Marburg and later at Herborn and Burgsteinfurt regarded their science as essentially speculative and followed the synthetic order in the presentation of doctrine.

Rejecting the Lutheran transposition of the tracts on salvation and soteriology in systematic works on theology, they took the glory of God and predestination as their point of departure. Reformed dogmatics began with God as the first cause and final goal of all things, and treated his eternal decrees of providence and predestination before taking up his government of the world in time.

The idea of a systematic encyclopaedia of knowledge deriving from a single principle was fundamental in Calvinist thought. Theology was thought of as part of the body of knowledge which has been acquired in the course of history. Natural theology is part of the science of spiritual being, revealed theology is a discipline made up of commonplaces systematically ordered for the understanding of the Scriptures. Philosophical conclusions are derived from the nature of things. Theological conclusions are derived from revelation and include not only universal, but also contingent facts depending on the divine foreknowledge.

In this conception natural theology formed an integral part of the *cognitio Dei perfecta* at which theology aimed. Consequently, whereas Lutheran writers on metaphysics sought to maintain the unity of Aristotle's science and only reluctantly admitted the necessity of an independent natural theology, Calvinist authors tended to distinguish clearly between two sciences, a science of God to the extent that he is accessible to human reason and a science of being understood as a universal science which supplies the principles for all the particular sciences.

In the preface to his *Isagoge in primam philosophiam* (1598) the Marburg professor Rudolphus Goclenius[10] took up a distinction, first advanced by the Jesuit Benito Pereira,[11] of metaphysics into a universal science called "first philosophy" and a particular science called "metaphysics". First philosophy deals with being, its properties and its principles; metaphysics studies the various types of immaterial being: God, the intelligences and the human soul.

Goclenius composed no treatise on metaphysics as the science of God, but his *Isagoge* is an introduction to first philosophy as the science of being. The work has two parts, the second of which deals with individual questions in the form of disputations. The first part, entitled *Praecepta metaphysica*, contains his complete treatment of the science. The first chapter deals with the definition of first philosophy and the notion of being, chapters 2-15 take up the simple and conjunct properties of being and the last three chapters treat substance and accident as its principles.

Goclenius seems to have been aware of the difficulties involved in restricting the term "metaphysics" to the science of God while speaking of the science of being as "first philosophy". In his *Lexicon philosophicum* (1613) he made a new and important addition to philosophical terminology. In the article on abstraction he divided the speculative sciences according to the types of abstraction from matter that characterise them; that employed in physics he described as "physical", that made use of in the science of God and the intelligences as "transnatural" and that used in the science of being and the transcendentals as "ontological".

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[10] Ibid., 169-70.

[11] Ibid., 313-20.

The term occurs here in its adjectival form, but it soon appeared as a noun. The term "ontology" made it possible to recognise the claim of the science of being to be metaphysics just as much as the science of God. It was in this way that the term "metaphysics" came to designate both the universal science of "first philosophy" or "ontology" and the particular or special science of "natural theology".

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The significance of the Calvinist approach to metaphysics was not limited, however, to terminological innovation. In the works of authors like Bartholomaeus Keckermann (†1609) of Heidelberg and Danzig,[12] Clemens Timpler (†1625) of Heidelberg and Steinfurt,[13] and Johann Heinrich Alsted(†1638) of Herborn[14] there appeared a new, unified vision of the encyclopaedia of the scientific disciplines in which ontology had the role of assigning to each of the particular sciences its proper domain.

This new vision was grounded in a conception of the scientific enterprise which was specifically a product of the Renaissance, a conception which set it apart from the Aristotelianism of both Catholic scholasticism and Lutheran orthodoxy. According to the traditional Aristotelian understanding, scientific knowledge was made up of conclusions which are not only true, but also certain, because they are the result of a demonstration based on an evident principle or cause. Science was the habit or faculty by which the mind is disposed to assent to such conclusions. The habit of science was thought of as being acquired by an act of demonstration and increasing as more and more conclusions were drawn from principles.

Writers of the Reformed Confession broke with this conception. In their approach science was understood not as a habit, but as a body of knowledge, systematically ordered so as to make it possible for a learned man to impart the habit of scientific knowledge to others by correct explanation. Their notion of a *corpus doctrinae* differed from the Lutheran idea in a way which betrayed the influence of humanism.

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[12] Ibid., 209-10.

[13] Ibid., 454-6.

[14] Johann Heinrich Alsted, *Encyclopaedia*, 7 vols., Herborn 1630; repr. W. Schmidt-Biggemann (ed.), 4 vols., Stuttgart 1989-90.

Whereas Lutheran writers concerned themselves exclusively with theological doctrines and sought simply to show the logical connections between individual theological teachings, the Calvinists saw theological doctrine as part of the sum total of the knowledge which has been gained by man in the course of history and transmitted to the present generation by written and oral tradition. The task of the scientist was to systematize the teachings of each of the disciplines—including theology—and to relate them to one another in a new encyclopaedia of knowledge.

At the same time, men like Keckermann departed in another way from the traditional definition of scientific knowledge. According to Aristotle, only necessary, universal statements can be scientific; there can be no demonstration of contingent, singular facts and no science of changeable things as such. But because Reformed theologians wanted to assure the scientific character of theological conclusions, they extended the range of scientific validity beyond the universal conclusions which natural theology can derive from the properties of things to the singular, historical facts, dependent on God's providential care, which revealed theology holds, on the testimony of Scripture, to be principles of knowledge.

In his *Praecognita philosophica* Keckermann presented a general theory of science in which he appealed to the norms of certitude which had been proposed earlier by Melanchthon: revelation, universal sense experience, common innate notions and the orderly presentation of syllogistic conclusions.[15]

Keckermann went beyond Melanchthon, however, by defining the *intellectus ordinis in syllogismo* as *facultas artificialis acquisita per certam disciplinam.* By "faculty" he meant an internal source of certitude which is a habit or disposition—in accordance with the Aristotelian conception. By the "discipline" through which the habit is acquired he meant the external body of doctrine which the learned man must master. The most significant word in Keckermann's definition is the word "artificial". He described the habit acquired by the learned man not as "scientific" but as "artificial", because it concerns conclusions which belong to all the liberal arts and includes both universal conclusions drawn from the nature of things and singular, contingent conclusions based on testimony, for the reason that knowledge of both types of conclusion can be gained by the systematic application of methodical principles.

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[15] Philipp Melanchthon, "De anima: Causae certitudinis doctrinarum.," in: *Corpus Reformatorum, Philippi Melanchthonis opera, quae supersunt omnia*, 28 vols., Halle 1834-60, reprinted: New York 1963, vol. 13, 149-53.

The emphasis in this new theory of science was thus placed, above all, on the orderly, systematic presentation of doctrine. A discipline in the liberal arts is a system of precepts and rules, methodically ordered, through which one can—with the requisite natural ability and corresponding practice—gain the habit of knowledge in the liberal arts.

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Around the beginning of the last quarter of the sixteenth century the term "system" began to be used by Reformed theologians for ordered compilations of Christian teachings. The term acquired its technical sense of a body of knowledge unified by a single idea or principle in writers like Keckermann. These thinkers understood each of the liberal arts as a system of precepts and rules according to which a given subject-matter is arranged for correct explanation. The precepts (*praecepta*) are made up of definitions and distributions. The rules (*regulae*) are made up of conclusions; they are called "theorems" in the speculative disciplines and "canons" in the practical ones.

The principle or idea according to which the precepts and rules are ordered is not merely an external principle, so that the elements are simply parts of a whole, but one which grounds the knowledge of the elements and coordinates their real functions. Theological rules are derived, in the analytical order, from revelation; philosophical rules, in the synthetic order, from *ipsa rerum naturalium natura* or *notitiae nobiscum natae*. Revealed theology is a discipline consisting of rules (*loci communes*), disposed systematically for the understanding of the book of Scripture. Natural theology is that part of the discipline of pneumatics which consists of rules concerning God's existence, essence, eternal decrees and temporal government of the created world, as they can be read in the book of nature. The other two parts of pneumatics are angelography and psychology.

The idea of each of the liberal arts as a system found its logical counterpart in the idea of the encyclopaedia of the arts. It was at this point that the new conception of scientific knowledge espoused by Reformed thinkers affected the traditional role of metaphysics as the queen of the sciences. Keckermann and Timpler composed systems of logic, rhetoric, physics, mathematics, optics, astronomy, geography and the various parts of practical philosophy. Keckermann and Alsted also drew up systems of theology.

All of these systems taken together were regarded as forming a unified whole. Alsted published a complete edition of Keckermann's works in 1613 under the title *Systema systematum.* His own *Cursus philosophici encyclopaedia* appeared in 1620 and ten years later his complete *Encyclopaedia* for all four university faculties.

For each of these authors the system of metaphysics had the task of assigning to each of the disciplines its proper domain and its place in the encyclopaedia of the arts. Pneumatics was to deal with spiritual reality, physics with corporeal reality as corporeal, mathematics with quantity, practical philosophy with human actions as moral, law with human actions as political, medicine with the human body as to be cured. Accordingly, the metaphysics which—as first philosophy—formed the foundation of this encyclopaedia was no longer understood as a science in the Aristotelian sense, but rather as one of the liberal arts. Metaphysics thus became closely connected with the theory of the arts, which these authors, employing the Greek word, named "technologia".

Clemens Timpler was the thinker who was most consistent in drawing the consequences of the understanding of the sciences as liberal arts. He prefaced the second edition of his *Metaphysicae systema methodicum* of 1606 with a *Technologia seu tractatus generalis de natura et differentiis artium liberalium.* Alsted opened his *Encyclopaedia* with a general account of the new theory of scientific knowledge. Under the title *Praecognita philosophica*, he treated the theory of the habit of knowledge, the theory of the arts and didactics. For the third section of this introduction he also used the neologism "technologia". But Timpler went a step further. Because the individual systems which make up the encyclopaedia of the liberal arts are bodies of doctrine, the discipline which coordinates them must itself be less a theory of being than a theory of human creativity through knowledge. For this reason, this discipline, although *ordine inventionis* it follows the other disciplines, must *ordine doctrinae* precede all of them.

Consequently, Timpler proposed that the subject-matter of metaphysics is not being, but rather the conceivable, πᾶν νοητόν. The subject-matter which the art of metaphysics systematically considers is everything which human reason can conceive of as possible. Since the arts and technology are concerned with making, metaphysics is the fundamental art grounding a new encyclopaedia—a new dynamic system of all systems.

STURM, MORHOF AND BRUCKER VS. ARISTOTLE: THREE ECLECTIC NATURAL PHILOSOPHERS VIEW THE ARISTOTELIAN METHOD*

Constance W. T. Blackwell

During the last thirty years renewed interest in the writings of philosophers working within the Aristotelian tradition has revolutionised the way that knowledgeable historians of philosophy and science view the way in which philosophy was reshaped during the fifteenth, sixteenth and seventeenth centuries, those three crucial centuries of the early modern world. We owe this change in perspective to, among others Baldini, Kessler, Lohr, Schmitt and Wallace, who have established that among the variety of Aristotelisms taught in the universities some helped to effect the transformation of natural philosophy and metaphysics which, directly or indirectly, underpinned what has been called the scientific revolution of the seventeenth. This has come as news not only to non-Catholics but to Catholics. When the Catholic historian of philosophy, Coplestone, wrote his history of philosophy not so long ago, Suarez was the only sixteenth- or seventeenth-century Aristotelian he studied in detail.[1] Even Ernst Cassirer in his ground-breaking work *Das Erkenntnisproblem* (a work that Schmitt credits with initiating the idea that the Renaissance philosophical tradition might have helped lead to the scientific revolution[2]) included only two Aristotelians, Pomponazzi and Zabarella, among his sixteenth-century philosophers and no Aristotelians among his seventeenth-century

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[*] I would like to thank Daniel Garber, Luce Giard, Sarah Hutton and above all Eckhard Kessler for conversations on the historiography of Aristotelianism which were central to the development of this paper.

[1] F. Copleston, S.J., *Late Medieval and Renaissance Philosophy*, part II: *The Revival of Platonism to Suarez*, New York 1963, 173-201.

[2] C. B. Schmitt, "Introduction," in: C.B. Schmitt, E. Kessler and Q. Skinner (eds.), *The Cambridge History of Renaissance Philosophy*, Cambridge 1988, 2.

philosophers.[3] One may reasonably ask how this version of the development of the scientific method came to be written. The process of forgetting, if I may call it that, began in the eighteenth century, not only because the Aristotelian method of natural philosophy had been supplanted, but because the creation of an individual and unique philosophical system was held to be the ideal way to philosophy by Brucker, the great creator of its canon. Brucker held that the best philosophy articulated an independent system of thought, while he criticised philosophers who either combined their philosophy with past systems or mixed doctrines of contemporary philosophical schools together, labelling these philosophers syncretic. Not only did he give syncreticism a bad name, but, by trying to purify philosophical tradition, he caused the dynamic way that philosophers had worked with past traditions to be written out of the history of philosophy.

In this article I shall in no way attempt to be exhaustive but will discuss three Protestant views of the correct method of philosophising, those of Johannes Christoph Sturm (1635-1703), Daniel Georg Morhof (1639-1691) and Jakob Brucker (1696-1770). Each viewed the relationship between the new science and Aristotelian tradition in a differing and suggestive way. Their three works are quite different from one another: Sturm's *De philosophia Sectaria et Electiva* (1679) is a dissertation written to defend his own teaching of eclectic Aristotelian natural philosophy at the University of Altdorf,[4] while Morhof's *Polyhistor*, in the genre of the *historia litteraria*, includes not only a discussion of the history of philosophy, but the history of literature,[5] and Brucker's *Historia critica philosophia* (1742-44; to which 1000 pages of additional notes were appended in 1767), is a comprehensive history of philosophy. What they have in common is a distinct view of the past which was shaped by a definition of philosophising that is little considered today—electicism.[6] All claimed to be eclectic, but each defined the term differently and each had his own view of what the philosophical tradition should contain. As a result, each has his own assessment of the Aristotelian tradition; each constructs his own interpretation of the history of philosophy; and each describes his own philosophical canon and the philosophers to be included in it. All three are very conscious of living in rapidly changing times and each in his own way tries to create order out of the mix of new traditions common in the seventeenth century and to relate them to older Greek and scholastic philosophies. I conclude with Brucker, because with him the decisive break between sixteenth-century and seventeenth-century philosophy is made, and the notion of a purity of philosophical tradition begins; it is he who transforms Aristotle into a historical figure of the philosophical past.

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[3] E. Cassirer, *Das Erkenntnisproblem in der Philosophie und Wissenschaft der neueren Zeit*, Berlin 1906, ^{2}1911, vol. 1.

[4] J. C. Sturm, *De Philosophia Sectaria et Eclectiva, Exercitationes Academicae*, Altdorf 1686, 1-81.

[5] G. D. Morhof, *Polyhistor literarius, philosophicus, practicus*, Lübeck 1714.

[6] For a comprehensive overview of the tradition see M. Albrecht, *Eklektik*, Stuttgart-Bad Cannstatt 1994. The term was first widely publicized by J. G. Vossius in *De Philosophia et Philosophorum Sectis*, The Hague 1653, 222:

Johannes Christopher Sturm,[7] although little known today, was well known in his own time, and Zedler reports that the Royal Society possessed his portrait.[8] One of the early proponents of Robert Boyle's experimental method in Germany, his dissertation *Philosophia Sectaria et eclectiva*, first published 1679, was written to defend his method of teaching natural philosophy from the criticism of his fellow teachers at Altdorf.[9] The dissertation places both contemporary Aristotelianism and other contemporary philosophy within the tradition of ancient philosophy and presents philosophy as a continuum extending from the ancient times to the present. Albrecht rightly comments that the eclectics who saw the past continuing into the present have been overlooked by those working on the Ancients and Moderns problem. The work is divided into five chapters: the first, *Quid utrumque nomen praecise sibi velit praefationes*

"Tandem Potamo Alexandrinus pertaesus de omnibus, sectam Electicorum instituit: quae ex omnibus, quod optimum, eligebat, nullius authoritati addicta ... (Laertius) Scripserat etiam Philosophiae suae, id est elementa idem Potamo. Hanc Philosophiam Ecclesiae doctores fere omnes secuti sunt."

[7] For Sturm see Albrecht (as note 6), 309-57 and J. H. Zedler, *Universal Lexicon*, Leipzig/Halle 1744, vol. 40, 1423.

[8] Zedler, *Universal Lexicon* (as note 7), vol. 40, 1423.

[9] J. C. Sturm, *Philosophica sectaria et eclectiva*, respondente Johann Christophorus Sauter, Altdorf 1679; *Exercitiones Academicae*, Altdorf 1686, 1-81. His major works are *Colligium experimentale sive curiosum*, Nuremburg 1676-86, which includes a great deal of information about Boyle's experiments as well as a letter to Henry More and *Physica electiva sive hypothetica*, Nuremburg 1697-1722. See Sturm's statement on eclectic method in the *Physica*, fols. b3v-d3r: "Particular praeliminarium, Articulus 11, Eclecticam ac Hypotheticam circa res naturales philosophandi methodum."

loco, exponens defines the term eclectic by identifying it with Clement of Alexandria who maintained that it was a philosophy which was neither Stoic, nor Platonic, Epicurean nor Aristotelian but, which selected from all the sects;[10] the second, *De Philosophiae Electivae necessitate, utilitate & praestantia* established the necessity of eclecticism as a scientific method in the seventeenth century because the great variety of discoveries about the natural world which continually changed descriptions of the fields could only be accommodated by the eclective method; while the third, *De Philosophiae Sectariae incommodis & illaudabili conditione,* argued that sectarian philosophy was not a useful method for describing natural philosophy. The fourth chapter, *De Philosophiae Electivae priscis modernisque cultoribus*, discussed both the ancient and modern cultivators of eclecticism, and the final chapter, *Ad ea quae morari nonnullos possent dubia breviter respondens*, answered further doubts the audience might have had about eclecticism.[11]

Two points are central to Sturm's description of eclecticism. First, the eclective method had of necessity to use reasoning by hypotheses rather than certitude since human beings could not know enough to establish scientific certainty. He illustrates this by noting that Casper Bartholinus' *Anatomiae Institutiones* had been printed four times in a little over ten years.[12] He also remarks that such great men as Huygens, Gregory, More, Boyle, Hooke, Auzutus, Petit, Hamel, Malpighius may have admitted that they disagreed with each other, but that this did not cause quarrels because they all knew that one man did not knew everything.[13] Secondly, Sturm maintains that Aristotle himself had been an eclectic; he was not the philosopher, but one philosopher among many. Sturm backs this up with a quotation from a contemporary Aristotelian, Christian Dreier, who argued that philosophy was not the invention of one man but of many, and that Aristotle knew this.[14] Sturm substantiates this view by referring to *Metaphysics*, chapter 2, book 1 where Aristotle said that contemplation of truth is on the one hand difficult, on the other easy. No single problem can be expressed in a way that is adequate to it; nor is everyone collectively in error. For further confirmation Sturm then turns to the comment on this sentence made by Alexander of Aphrodesias: each person says something about the nature of the truth and though individuals may contribute little or nothing to it, when all those things are heaped together any thing which anyone has said correctly attains a certain greatness.[15]

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[10] Sturm, *Philosophica sectaria* (as note 9), 56: " Philosophiam dico, non Stoicam, neque Platonicam, aut Epicuraeam, aut Aristotelicam, sed ea omnia quaecunque ab unaquaque secta recte dicta sunt, justitiam cum piae scientia edocentia, omne hoc eclectivam voco Philosophiam."

[11] Ibid., Caput I, 1-14; Caput II, 14-8; Caput III, 28-43; Caput IV, 43-64; Caput V, 64-81.

[12] Ibid., 18-9: " In unico hominis corpusculo adeo multa detexit a paucis annis Anatomicorum Physicorumque recentorum industria, ut non immerito, quam anno abhinc duodecimo *Clariss. Bartholinus* denuo eddidit, *Anatomiam quartum Renovatam* indigitavit, paulo positerum renovandam dubio procul, & loco non uno corrigendam." Sturm must have been referring to Thomas Bartholinus, *Anatomia ex C. Bartholini parentis Institutionibus reformata,* which was published in four editions between 1651 and 1669 and again in 1686.

[13] Ibid., 23: "Hinc videas hoc aevo HUGENIOS, GREGORIOS, MOROS, BOYLIOS, HOOKIOS, AUZUTOS, PETITOS, HAMELIOS, MALPIGHIOS,

Sturm maintained that all great philosophers followed this form of eclecticism. Thus, unlike the followers of the *prisca theologia* who believed that Adam, Moses, Zoroaster and Hermes had the timeless truth, and the followers of the *prisca sapientia* who believed Moses and the Egyptians had scientific knowledge, Sturm maintained an approach to the history of philosophy which permitted a philosopher to study and to judge past knowledge, but also to add new information of his own. This method, Sturm claimed, had been practiced since the earliest Greeks.

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aliosque quam plurimos inter se dissentire quidem & scriptis concertare, sed ea comitate, ea modestia, ut dum confutare quaedam alter in alterius libris audet, non tantum ea encomia quibus aliorum judicio isti digni visi sunt non dissimulet, sed suo quoque exornet ..."

[14] Ibid., 47: "... quod idem Clarissimus Drejerus in *Phil. Primae Praef.* ad Lect. inter cumulatissimas hujus Philosophi laudes primo loco his verbis commemorat: *Philosophia unius hominis inventum non est, sed plurimorum per tot secula experientia nititur, Inter omnes vero qui aliorum experientiam & observationes comportarunt & literis mandarunt, excellit unus Aristoteles.*
Quandoquidem autem ab Aristotelis aevo ad haec nostra usque tempora viginti circiter effluxere secula, ingeniorum praeclarorum non minus quam superiorum ullum, feracissima, industriae vero laude ac indefatigibili experimentandi naturaeque ..."

[15] Ibid., 48-9: "Alpha Min in Metaphysica his expressis verbis dedit prudentissimum... h.e. *Contemplatio veritatis partim difficilis est, partim facilis: Sapientia, seu philosophia prime ex Aristotele et optimis antiquis indicio autem, quod neque digne quispiam assequi eam* (solus puta) *possit, nec omnes* (tamen ab ea) *aberrent, sed unusquisque aliquid de natura dixerit* (& recte quidem, ut Alex. Aphrod. in Comment. interpretatur, dixerit) *& quod singuli quidem nihil aut parum ad ipsam conferant, ex omnibus autem* (iis quae quisque recte dicit) *congestis magnitudo quaedam fiat.*"

Thus although Diogenes Laertius had claimed that Potamon of Alexandria was the founder of the eclectics, Sturm asserts that the leaders of the earlier sects had all been eclectics even though they did not use the term: Pythagoras was an eclectic as he owed part of his philosophy to the Thracians, part to the priests of Egypt, part to the Magi of Persia, part to the Jews and part to the Greeks, and so was Democritus who owed much to the Egyptians, the Chaldeans and Persians and the concept of atoms from Leucippus.[16] Cicero and Seneca also philosophised eclectically.[17] If Sturm called ancient philosophers eclectic, he also pointed out that the ancient and contemporary commentary tradition provided evidence for the history of eclecticism and lists commentators on Aristotle from Alexander of Aphrodisias to Arriaga.[18]

Turning to his own age, Sturm describes Descartes as an eclectic and martials evidence to prove his point: Hobbes had remarked Descartes used doubt on the uncertainty of the senses rather like Plato, while Arnauld had pointed out that Descartes used doubt in the same way as Augustine in book 2 of *De libero arbitrio.* Finally Sturm observes that Democritus' atoms were in reality the same as the particles of matter described in Descartes. Sturm concludes that Descartes could not have been ignorant of these philosophers but wished to appear self-taught and as a result he was silent about those he followed and did not acknowledge his sources.[19] If Descartes was really an eclectic, then so too were Bacon and the Jesuit

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[16] Ibid., 44: "De *Pythagoras* certe prolixe ostendit Eruditissimus Vossius de Philos. Sectis Cap. VI eum Philosophiae suae partem unam Thracibus, aliam Aegyptiis sacerdotibus, ac nominatim Sochidi Aegyptio Archiprophetae, ut eum nominat Clemens Alex. in 1 Strom. partem etiam Persarum Magis & Chaldaeis nonullam quoque Judaeis, aliquam denique Graecis, imprimis Pherecydi Syrio, deber, *Democritus* in Philosophia habitus, ut ait Laertius, praeter Aegyptios, Chaldaeos, ac Persarum Magos, etiam Indorum Gymnosophistas, amore Philosophiae, adiit, teste Aeliano Lib. IV var. Histor. atomos autem & inane spatium infinitum a Leucippo acceptit ..."

[17] Ibid., 57. Sturm quotes from Cicero *N. D.* IV and Seneca *Ead Lucillio* 33 and 47.

[18] Ibid., 66.

[19] Ibid., 52. "Thomas Hobbius sub init. iii object. agnoscat quidem veritatem primae Medit. Cartes. sed de eadem incertitudine sensibilium disputasse Platonem, inquiat, & alios antiquorum Philosophorum, ideoque se nolle excellentissimum authorem novarum speculationum nomine illa vetera publicare (n.b. Cartesium ad haec respondere iis se usum esse non ut pro novis viditaret &c) Antonius Arnaldus D. Theol. Sarbonicus, in principio statim IVtarum obiect. miretur Virum Clarissimum (Cartesium puta) idem pro totius Philosophiae suae principio statuisse, quod statuit D. Augustinus Lib. ll de lib. arbitrio c. 3 &c."

Aristotelian, Honoré Fabri, who had been influenced by Descartes and was well known to Oldenburg and other members of the Royal Society.[20] Fabri's way of combining Descartes with Aristotle made him a model eclectic and Sturm quotes with approbation from Fabri's educational method set out in book 2, chapter 1, *De libertate animi* in Ephiander.[21] Other contemporary eclectics are Johannes Baptist Du Hamel, the Italian natural scientist Francesco Redi[22] as well as the method of scientific investigation of the Royal Society.[23] Sturm's philosophical frame of reference is Aristotelian and when he discusses philosophical method he speaks about imitating Aristotle. By this he means that the contemporary philosopher should imitate Aristotle's method of studying by selecting from past philosophers and adding his own knowledge to the earlier observations and reflections. Rather than distancing the past, this historical method joined the past with the present. Not only was Sturm uninterested in studying the differences between the various philosophical traditions but he believed that to emphasise the differences while not looking for what these traditions had in common was to violate the eclectic method as he understood it.

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[20] He was so well known that, in a letter to John Winthrop Jr., Oldenburg recommended that Fabri's writings, among others, be included in the early library of Harvard College. On Fabri see: C. W. T. Blackwell, "The Case of Honoré Fabri and the Historiography of Sixteenth- and Seventeenth-century Jesuit Aristotelianism in Protestant History of Philosophy: Sturm, Morhof and Brucker," in: *Nouvelles de la République des Lettres* (1995), 55-83.

[21] Sturm, *Philosophia sectaria* (as note 9), 59: "Laudatus ante HONORATUS in egregio suo libello quem *Euphyandrum* sive *Virum ingeniosum* scripsit, Lib. II, Cap. I, de Libertate animi que Euphyandrum suum deceat, agens, inter cetera haec habet cedro sane dignissima: *In re civili, humanae societatis est, ut unus alteri fidem habeat & servet; at vero in re literaria, secus accidit; licet enim auctoritas magni momenti sit, sit tamen omni rationis praesidio careat, non video eam esse, cui Euphyander assentiri ac sese dedere iure debeat; hinc jurare in verba magistri non debet, nisi veritas ipsi magistra sit nec Thomastis, nec Scotistis plus aequo addictus esse amici omnes sint veritatis amatores.*" see H. Fabri, *Ephiander* (Lyon, 1669), 61.

[22] Fabri, *Ephiander* (as note 21), 60-2.

[23] Sturm, *Philosophia sectaria* (as note 9), 63: "Quibus omnibus quidem, tanquam totidem legibus ac decretis regiis, quam digne se gerant in conventibus suis ejus Societatis membra, quam nulli ibi strepitus exaudiantus, oblocutiones nullae, altercatio nulla, nulla partium studia locum habeant, quanta dissentientium modestia mutuaque reverentia conspiciatur (maturi certe electivae Philosophiae fructus illustri adeo vivoque exemplo expressi) admirabundus narrat Anonymus quidam in enarratione itineris sui per Angliam gallice descripta sub forma Epist. a Marquis Vobrun Nogent, Gouverneur de Philippeville, etc quam in vernaculam nostram translatam Francofurtum ad Moenum, anno 1667 evulgavit."

In 1691, when Daniel George Morhof[24] completed as much of the *Polyhistor* as he was to write before his death, he viewed the history of Aristotelianism and the new philosophy or those he called the *novatores* in a different light. Like Sturm, Morhof had been deeply impressed by the new science and in particular with the new developments in England. In 1670, when Morhof went to London for the second time, he met members of the Royal Society, Glanvil, Boyle and Oldenburg and on his return translated Boyle's *History of particular Qualities* and four other tracts into Latin,[25] publishing them in Hamburg in 1671. In the following years Morhof wrote two additional works, the *Disputatio de sole igneo academica*,[26] and the *De metallorum transmutatione*,[27] which showed the influence of Boyle and other experimental philosophers. An orator, poet and teacher of jurisprudence, Morhof was also interested in the new scientific discoveries, but had a different view of the past than that of

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[24] The earliest and most complete biography of Morhof was written by Johannes Moller for his edition of D. G. Morhof, *Polyhistor, Literarius, Philosophicus et Practicus* (Lubeck, 1707), and was reprinted in subsequent editions.

[25] Ibid., *Prolegomena*, 41. "Anni 1670 partem maximam Itineri secondo ad Anglos & Batavos Literaro Noster impendi. Ex isto Kilonium A. 1671 redux, Opuscula quaedam Roberti Boylii, Naturae Scrutatoris felicissimi & incomparabilis, quocum in Anglia familiariter erat conversatus, Physica Latino donavit Idiomate ..." This collection of tracts: *The history of particular qualities, The cosmicall qualities of things, Cosmical suspitions, The temperature of suberraneal regions, The temperature of submarine regions, The bottom of the sea*, by Robert Boyle, was quite popular. It was published first in England in Oxford in 1670 and again in 1671. There is a copy of Morhof's Latin translation with a dedicatory poem to Boyle by Morhof in the Herzog August Bibliothek, Wolfenbuttel. Morhof must have worked from a copy of the 1670 version when he published his Latin translation in Hamburg in 1671. These translations have been overlooked by Boyle scholars.

[26] Ibid., 41, LXll: "Ipse deinde, in Scrutinio Naturae Arcaniorum Curiosiori, Boylium, aliosque Philosophiae Experimentalis Instauratores feliciter aemulatus Lynceos, complura & luculenta quidem ac praestantissima, illius subinde publicavit Specimina. Quorum primum, breve quidem, sed neutiquam poenitendum, fuit *Disputatio de sole igneo academica,* Kilonii A 1672 in 4to edita, Hamburgi A 1699."

[27] D. G. Morhof, *De metallorum transmutatione* (Hamburg, 1673). Morhof praises Boyle in his preface to Langelot: "Quae Vir illustris Robertus Boilius *de origine Metallorum & Mineralium* commentatus est, procul dubio, ut omnia Viri illius, eximia erunt & Elaboratissima, quantum e libello, ipsis, de quibus agit, gemmis pretiosiore, non ita pridem publicato augurari licet."

Sturm. He established immediately that the *Polyhistor* was modelled on Francis Bacon's project of a history of all the disciplines.[28]

Organizing his work historically, Morhof first listed the Greek sources for the various philosophical sects, next the Realists and Nominalists and ends with the *novatores*. Although he did not completely segregate the sects from each other, basically he ordered his information following the division of the Greek sects until he began to describe the *novatores* whom he saw as a mixed group of natural philosophers united by a common method. Thus while he did list some followers of the Greek sects, including Aristotle, as followers of the current scientific learning he basically contrasts the *novatores,* who used sense perception to establish scientific facts, with the Aristotelians who usually used deductive method.

The view of the intellectual reality of the seventeenth century given here is that no matter to which sect a philosopher was aligned, his philosophical ideas were developed from agreement or disagreement with Aristotelian doctrines.[29] Thus, the history of Platonism, Epicureanism, Pythagoreanism, and scepticism is told against the background of the Aristotelian controversies. Similarly, there are historians of philosophy among the Aristotelians: for example, Benedict Pereira, the Jesuit Aristotelian, is noted for the way he refutes and asserts doctrines of

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[28] Morhof, *Polyhistor* (as note 24), Tomus II, Lib. I *Bibliothecarius*, cap. 2, *de Historia Literaria*, 9: "Vastum Polymathiae nomen est, ac longe lateque extenditur, suis tamen spatiis limitibusque definitum: Latius vero patet HISTORIA LITERARIA, quae non ipsam tantum Polymathiam, sed & singularum scientiarum primos natales ac progressus ad nostra usque tempora complectitur. Nemo est, qui Oceanum hunc transmiserit; non pauci, qui littus legerunt. Historiam Philosophicam e veteribus & recentioribus per partes agressi sunt multi; sed omnem a natalibus suis Historiam literariam iam nemo....Majus animo Opus conceperat maximi vir ingenii BACO VERULAMIUS, qui inter sonsilia de ampliandis scientiarum terminis, hujus quoque Operis ideam proposuit *lib, 2, de Augm. Sc. ca4*."

[29] This view of sixteenth- and seventeenth-century philosophy seemed to me so suggestive that I organised a conference with the support of the British Society for the History of Philosophy and the Foundation for Intellectual History in Cambridge in April 1995 to discuss the various ways in which sixteenth- and seventeenth-century philosophers were in conversation with the various doctrines of Aristotelian philosophy. The proceedings will be published in C. W. T. Blackwell and S. Kususkawa (eds.), *Sixteenth- and Seventeenth-Century Philosophy and its Converstaion with Aristotle*, Aldershot 1998.

Aristotle's physics,[30] while the attacks of Gassendi, Bruno,[31] and Boyle on the Aristotelians are central to the chapter on the history of Epicurean philosophy. There is even an Aristotelian, Franciscus Sanchez, who is classed with the sceptics because he published a compendium of sceptical arguments which showed that nothing certain could be said.[32]

In the first book, the *Polyhistor Philosophico-Historicus*, Aristotle dominates. Morhof allots seven chapters to the Aristotelians while giving the other sects only one each. While some chapters on the Aristotelian commentators merely supply a good bibliography of Aristotelian material available in the late seventeenth century, it is in his chapters on *Nominalists* and *Realists* that Aristotelian method, particularly that practiced by the scholastics, is severely criticised. Here he flatly states that the writings of the scholastic Aristotelians contain little physics and mathematics and while they were a triumph of subtlety, the reader was none the wiser after reading them.[33] Yet Morhof read the scholastics with some care. For example, although he was familiar with Vives' and Pico's criticism of the work of the Nominalist, Swineshead, Morhof says that this is not a fair judgement. He finds Swineshead's doctrine of motion based on infinite modification particularly interesting: "What," he asks, "would Pico say today if he saw that the Cartesians, Boyle and others held the same view?"[34] And when he discusses the realists, after criticizing the inordinate praise of Thomas Aquinas, Morhof notes that various realists used differing methods, so that Ponzius and de Rada tried to reconcile Scotism with Aquinas, Lelemandet combined nominalism and realism, while the Jesuit, Cornaeus, was interested in astronomy. Morhof ends with praise for Zabarella and information about Jungius' attack on him.[35]

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[30] Ibid., tomus II, lib. 1, 5: "BENEDICTUS PERERIUS. Jesuita doctiss. fuit, eujus extant *Commentationes in Genesin* (quibus cum fructu usus est Sam. Bochartus in *Geographia sua sacra*) & *Libri 15 de communibus rerum naturalium principiis & aggectionibus*, Coloniae anno 1595 in 8vo. editi, ubi lib. 4 antiquorum Philosophorum placita, secundum Sectas, exponit, eorumque Auctores. Habentur autem illic tantum Physica, in quibus recensendis diligenter versatur, illa quoque refutans pro asserenda Artistotelis doctrina, cum studeat aliquantulum, in Veterum sententiis recte ponendis vacillare aliquando videtur."

[31] Ibid., tomus II, lib. 1, cap. v, para. 3-6, 28: "Prolixe illic de mundis disputat adversus Aristotelem pro immensitate & infinitate mundi, in infinito sc. spatio, infinita esse finite mobilia statuit, infinitos soles (fixas stellas) & tellures (planetas), & non esse compertum planetarum numerum circa hunc solem, neque spectabilem circa alios."

[32] Ibid., tomus II, lib. 1, cap. vi, para. 3, 31. "Libellus est exiguus, sed qui in compendium traxit pleraque Scepticorum argumenta, argute satis & nervose ... Plerumque enim Medici, vel in Theologia, vel Philosophia, novaturiunt. Non putarem tamen, adeo serio rem suam egisse Franciscum nostrum, eumque potius scriptionis suae habuisse finem, ut exagitaret Scholasticos, eorumque Philosophiam, ostenderetque, nihilo nos certiores fieri ex eorum scriptis, & longe incertiores esse, quam dudum. Multa sane in illo scripto sana sunt & arguta, quanquam non omnia probem."

[33] Ibid., tomus II, lib. 1, cap. xiii, para. 1, 73: "Parum ab illis praestitum est in Physicis & Mathematicis; in illis enim accuratior omnino indagatio instituenda erat. In solo notionum regno triumpharunt mirificis perplexisque subtilitatibus omnia implicantes, in quibus extricandis licet cerebrum uis ruperit, nihilo tamen in re ipsa sapientior erit."

Morhof's true intellectual allegiances become apparent in the last chapter of volume II, book 1, *De novatoribus in philosophia* where he describes the philosophers who specifically rejected Aristotelian doctrines and philosophised eclectically by basing their knowledge on information gained through sense perception. This, Morhof remarks, is a better method than philosophizing by a doctrine of Universals.[36] He includes the writings of the leading *novatores*: Telesio, Cardano, Carpentarius and Descartes and his followers, de Raey, Lipstorp, Morellio as well as the Jesuit, Honoré Fabri and the Dutchman, Heerboord, concluding with Paracelsus, Thomas Hobbes and Comenius.[37] His emphasis on the *novatores* is even more pronounced in volume II, book 2, part 1: *Polyhistor Physicus*, where he devotes a chapter each to the physics of the different philosophical sects. Only one chapter discusses the principles of Aristotelian physics, and here Morhof takes most of his information from those who attacked Aristotle. However, there is one Aristotelian whom he praises: Honoré Fabri, who, he says, followed Aristotle's meaning, not that of the Scholastics and Arabs, and who also drew upon Descartes and Epicurus. At the end of these remarks, Morhof adds that he does not know why Fabri remained an Aristotelian when he rejected the notion of substantial forms.[38] In this section Morhof the bibliographer breaks out in adjectives, proclaiming peripatetic philosophy to be filled with *tanta superstitione* and *ineptis quaestiunculis & vitiligiis*, while Cardano was described as *vir prodigiosus in omnibus omnino scientis*, Campenella as *omnium pene scientiarum ad suos sensus reformator*, Hobbes as *miracilem ingenii ejus ad paradoxologias propensionem*, and Descartes as *perspecacissimi vir ingenii, & Mathematicorum studiorum peritissimus*.[39]

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[34] Ibid., tomus II, lib. 1, cap. xiii, para. 4, 76: "Sed mirari merito debemus varietatem sententiarum & judiciorum. Quem enim adeo in caelum evehit laudibus Scaliger, illum, ut summum nugatorem, elevant Joh. Picus & Ludovicus Vives, hic *libro 5 de corruptarum artium causes* (ubi illi Rogerii nomen tribuit), ille autem subtilitates ejus vocat *quisquilias Svisseticas, quae nihil ad sciendum, vel ad usum, conferunt* ... Joh. Picus dict loco, editus est ille liber hoc tit: *Richardi Svisset questio de reactione, Venet., apud Octavianum Scotum, anno* 1529. Plura de illius scriptis expiscari non licuit. Ceterum Picus exagitat infinitas ejus subtilitates, de motu uniformi, difformi, uniformiter difformi, difformiter difformi, de infinite raris aut densis, de hora secta in partes proportionales hoc aut illo proportionis genere. Picus illa inventa esse dicit *ab otiosis hominibus, aliarum rerum omnium inscientibus, ad exercendum in scholis guttur, ne tacendo obduceretur situ.* Haec Picus, vir utique non obesae naris, adversus Scaligerum, tot Autorum Hypercriticum, judicare non est veritus. Sed, si meam his sententiam dicere licet, judicio, quantum ex titulo huius libri colligere possum, rem illam non contemni debere. Motus enim doctrina infinitis modificationibus constat, in quibus si idonee ingenium exercuit Swissetus, profecto condemnandus non est. Qui diceret Picus, si hodie videret subtilissimas illas speculationes Cartesianorum, Boylii, atque aliorum, circa varios motus particularium?"

[35] Ibid., tomus II, lib. 1, cap. xiv, para. 104, 101: "Jacobus Zabarella Patavinus, nemini ignotus Autor, de quo prolixe verba facere opus non est. Scripsit in Logicis & Physicis & de Anima, multa omnibus celebrata Peripateticis. Editit illius opera integra Johannes Ludov. Havenreuterus, Medicus & Philosophus in Academia Argentorat., Francofurt."

[36] Ibid., tomus II, lib. 1, cap. xv, para. 1, 108: "Factum vero fuit a rebus naturalibus initium. Nam, cum illae in sensus incurrenerent, ac in notionibus plerique & speculationibus subsisterent Scholasticorum, ad sensus viam reducere

In his final chapter of book 2, part 1, chapter 19, *De recta principiorum physicorum constitutione*, Morhof sets out his principles of eclectic reasoning in six principles and essentially embraces a modified scepticism. Firstly, no sect can discover the complete truth: no sayings of any one sect can be completely accepted, nor can they be completely rejected. Where one is deficient the other may have the answer.[40]

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demonstrationes suas laborarunt, & in singularibus exercere ingenium, ut expeditior esset Universalium doctrina."

[37] Ibid., tomus II, lib. 1, cap. xv, 108-20, *De novatoribus in Philosophia*.

[38] Ibid., tomus. II, lib. 2, part 1, cap. xii, para. 3, 218: "Causa certe non est, quare Aristotelem deseramus, si hoc modo in Physicis philosophemur. Decantatas illas Peripateticorum formas rerum substantiales in Aristotele non invenit, ideoque nec illam sententiam approbat."

[39] Ibid., tomus. II, lib. 2, part 1, cap. xiv, 240.

[40] Ibid., tomus. II, lib. 2, part 1, cap. xix, para. 1, 225-6: "Quod si iam recta principiorum Physicorum ratio inuenda est, id primae hypotheseos hoc assumendum nobis est, in nullius sectae placita absolute jurandum esse, nec illa omnia ejuranda; quandoquidem ita comparatae sunt res humanae, ut non omnia omnes

Second, not all phenomena can be demonstrated mathematically, because some are more corporeal or belong to the air and should be deduced by probable arguments not by demonstration.[41] Third, the natural philosophy of the heavens should be free of conjectures. Fourth, Aristotle's abstract notion of nature is more appropriate to metaphysics.[42] Fifth, since physical science should know the nature and arrangement of mixed bodies which are known through the senses, the philosophical sects which should be consulted are those that philosophise using evidence drawn from sense perception (thus the clearest meaning must be sought in particulars, as Democritus, Epicurus and Descartes had done).[43] Sixth the nature of mixed bodies must be found by experience.[44]

Part 2 of volume II, book 2 of the *Polyhistor physicus* places Aristotelian physics in a even less advantageous light. The first chapter states that the pre-Socratics described the principles of natural bodies better than Aristotle, because he described them as formed from his intellect while they described natural bodies through sense perception, as Bacon had said.[45] Morhof goes on to say that the abstract notions of logic are difficult to understand and apply better to metaphysics than to

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videant, ideo quasi sucenturiandae sunt sententiis sententiae, atque ubi una deficit, respondendum ex altera."

[41] Ibid., tomus. II, lib. 2, part 1, cap. xix, para. 1, 266-7: "Secundo supponendum est, impossibile esse omnium phaenomenorum naturalium Mathematicas dare demonstrationes. ... Si omnium inter se sectarum principia conferamus in uno aliquo incognito scil. principio deficiunt, quod naturae plus quam corporeae et spiritualis esse probabilibus argumentis colligitur, non vero ita demonstratur, ut satisfacere plenae cognitioni possit."

[42] Ibid., tomus. II, lib. 2, part 1, cap. xix, para. 3, 267: "Abstracta illa Aristotelis principia, quae Metaphysica potius sunt, quam physica, seu universalia quaedam de rebus formata."

[43] Ibid., tomus. II, lib. 2, part 1, cap. xix, para. 4, 267: "Verum, cum praecipua Physicae scientiae pars sit corporum mistorum naturam et rationem cognoscere, ea enim sensibus propriora sunt, eas Philosophorum sectas perlustremus, qui ad sensuum ductum philosophantur. Atque hic quidam sensuum summam quam possunt subtilitatem sequuntur in particulis, quare omnis illa particularum doctrina, e mente Democriti, Epicuri, Cartesii, conferenda & examinanda est."

[44] Ibid., tomus. II, lib. 2, part 1, cap. xix, para. 5, 269: "... ultimo corpora ipsa mista per experientiam, secundum naturae methodum instituendam, resolvenda sunt."

[45] Ibid., tomus II, lib. 2, part 2, cap. i, para. 1, 271: "Principia corporum naturalium, ut vidimus, veteres Philosophi, ante Aristotelem, non ex intellectu suo formabant, sed ex ipso sensu rerum."

physics.[46] He then takes one topic after another, the affection of common bodies, the vacuum, time motion, qualities, occult qualities, magic, the sky, stars, fire, air, and sea and contrasts current new views of these topics with those of Aristotle. Unlike Sturm who depicted the new method of philosophizing as one which followed the progressive method that Aristotle himself used, Morhof distinguished the *novatores* who reasoned eclectively and used sense perception from an Aristotle who reasoned deductively and held the notion of substantial forms. However, Morhof did not group all Aristotelians together as Brucker was to do. While some could, in his view, be regressive scholastics, others could be sceptics and some, like Fabri, *novatores.* A clear division between the Aristotelians and the newer philosophical traditions had not yet been made but an important assessment of the new philosophy was spelled out in great detail which made it clear that the new philosophy had developed from a conversation with Aristotelian philosophy and with contemporary eclectic followers of the Aristotelian tradition.

Jacob Brucker, writing fifty years later, places Aristotle and the Aristotelians in the past, but this is a past which is described very differently from that which Sturm and Morhof knew and about which they wrote. Brucker, the great purifier of the philosophical tradition, identified certain philosophers who wrote in the seventeenth and eighteenth centuries as modern: eclectics who rejected all of the philosophy written by all the Greek sects and developed their own philosophical systems, or those philosophers who made innovations in one of the four branches of philosophy, logic, natural philosophy, metaphysics and ethics. The eclectics included Bacon, Descartes, Hobbes, Christian Thomasius, and Leibniz as philosophers with complete philosophical systems, Cardano, Campanella and Bruno as eclectic philosophers with imperfect systems. Among the innovators of the various branches of philosophy were Ramus and Locke among the logicians, Galileo, Boyle and Newton among the natural philosophers and Puffendorf and Grotius among the innovators of ethics. Brucker separated these philosophers and from those who restored ancient philosophy be they, Ficino recovering Plato and Plotinus in the fifteenth or Gassendi reconstructing Epicurus writing in the seventeenth.

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[46] Ibid., tomus II, lib. 2, part 2, cap. i, para. 1, 271: "Meliori certe jure Logica illa vel Metaphysica possunt dici principia, quam Physica, nihil enim aliud sunt, quam Termini & Notiones quaedam abstractae, in quibus intelligendis primum est magna difficultas, major in applicatione ad res ipsas."

While there might have been much to admire about these men, in particular Caramuel Lobkowitz, Honoré Fabri, Gassendi and Telesio, they all failed because their philosophical method did not rely sufficiently on their own thought but was too derivative, drawing excessively on Greek philosophy.

Aristotle and the Aristotelian tradition were simply not the focus of Brucker's book. Where Morhof included seven chapters out of twelve in his *Polyhistor philosopho-historicus* on the history of Aristotelianism philosophy, Brucker includes only one sixty-five page chapter on Aristotle in his one thousand, three hundred and fifty-seven page volume on ancient philosophy, then, separated by nine hundred pages on Alexandrian philosophy, he dedicates one section of volume III to scholastic philosophy and includes two chapters (one hundred and thirty-five pages out of seven hundred and eighty-five in volume IV) in which those who revived ancient philosophical systems in the Renaissance and seventeenth century are discussed. Aristotle does not even appear in the index of volume V, where Brucker discusses eclectic philosophers, although this is misleading as he is referred to in the text. When Brucker does discuss Aristotle or the Aristotelians he focuses on their doctrines and the extent to which their adherence to Aristotle kept their natural philosophy from developing. In the case of those whom he identified as "genuine Aristotelians" he shifts his emphasis and concetrates his discussion upon the extent to which they were able to philosophise without succumbing to the Aristotelian notions of the mortality of the soul and the eternity of the world.

Nevertheless, it is important that it be acknowledged that Brucker rescued Aristotle from seventeenth-century Protestant attacks which vilified him as an atheist. He reconstructed Aristotle's life, studied his philosophy in detail, and in the process created a new historical Aristotle. Brucker was able to place Aristotle in historical context because he was able to draw upon information available from the various Greek lives of Aristotle that had been collected by seventeenth-century scholars and which were identified in both Morhof's bibliography and Fabricius' *Bibliotheca Greca*.[47] Writing a chapter that was mid-way between the bibliographical lists of Morhof's *historia literaria* and the philosophy of a later Tennemann, Brucker included a list of ancient and more recent sources, giving particular praise to Andreas Schott's comparison between Aristotle and Demosthenes,[48] as well as the contrasts between Aristotle and Plato offered by Patrizi and by Rapin. Brucker is not uncritical of certain aspects of Aristotle's philosophy and like Morhof criticises his doctrine of substantial forms. Interestingly Brucker explains it as a Platonic influence (Plato was a philosopher whom Brucker criticised extensively).[49] Brucker is also able to admit Aristotle's genius, and tells the story from Philoponus that Plato called him *mentem scholae*.[50] Perhaps most importantly he narrowed the topics included in the discussion of Aristotle's atheism to one point—his denial of divine providence.[51]

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[47] J. A. Fabricius, *Bibliotheca Graeca, Notitia scriptorum veterum Graecorum*, Hamburg ^{3}1717-1727.

Since Brucker viewed any philosopher who followed one of the Greek sects as a failure, it is not surprising that he reclassified as mere followers of the Greek sects those philosophers whom Morhof had called eclectic or *novatores*. Take for example the curious case of the French Jesuit Honoré Fabri, who had been seen as a model eclectic by Sturm and as one of the *novatores* by Morhof. He was placed by Brucker in the chapter *De philosophis Aristotelico-scholasticis recentioribus* (where Brucker placed all Aristotelians who belonged to religious orders).[52] The other Aristotelians whom he grouped in *De philosophis genuinam Aristotelis philosophiam sectantibus*[53] either used the new translations of Aristotle which tended toward what Brucker thought was impiety or were potentially atheistic positions influenced by Averroism or followed what Brucker identified as a Christianised Aristotelianism of Melanchthon and his followers.

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[48] A. Schottus, *Vitae comparatae Aristotelis ac Demosthenis*, Augsburg 1603.

[49] J. Brucker, *Historia critica philosophiae*, Leipzig ^{2}1767, vol. 1, 809-10: "Demonstratio sit ex conclusionibus aeternae veritatis: ex quo sequitur, rerum fluxarum nec demonstrationem dari, neque scientiam, neque defintiones quoque ... hoc Platonicae philosophiae fuisse, quo fundamento tanqum lapide angulari, totus cardo doctrinae de ideis vertebatur. suo loco probavimus. Nec recedere ab hoc sententia ausus est Aristotels, etsi pulchre videret, ideas, sive substantias a rebus abstractas inane figmentum cerebri Platonici esse: cum vero errorem istum, essentias rerum in eiusmodi naturis communibus versari, non dimitteret, ad opinionem, Platonica non meliorum, delapsus, eiusmodi naturas communes, in rebus singularibus subsistentes asseruit..."

[50] Ibid., vol. 1, 780. "Adeo vero iudicii, quo pollebat acumine, et ingenii elegantia se Platoni commendavit, ut charissimus ei fieret, multumque ei diligentia et eruditio eius probaretur: estque auctor Io. Philoponus, Platonem illum vocauisse *mentem scholae*."

[51] Ibid., 832-4.

[52] Brucker (as note 49), vol. 4, 117-48.

[53] Ibid., 148-352.

This reclassification of Aristotelianism had an important repercussion on the study of Renaissance philosophy. While Brucker's classification underlined that the retranslation of Aristotle was so important that those who philosophised from these texts deserved to be identified as a new school, it also caused something more significant to take place, in that it removed the Realist-Nominalist debate from Brucker's discussion of sixteenth- and seventeenth-century philosophy. As a result the debate vanished from the major histories of philosophy of the Renaissance. Indeed the lack of discussion of these philosophical debates continues today except in the work of Trinkaus and Kessler.[54]

While we may criticise this classification, it is also true that Brucker's discussion of sixteenth- and seventeenth-century scholastics is extremely important for the historiography of philosophy and for our knowledge of Aristotelian method in the eighteenth century. His critique not only tells us what Brucker read and how he evaluated it, but also helps us to know what later historians of philosophy found when they came to use Brucker as a source book. Like Morhof, Brucker knew and read the works of the sixteenth- and seventeenth-century scholastics and judged them by the extent to which they participated in the innovations of the new science and were able to philosophise independently. The scholastic whom he described with the most care was the Cisterian, Joannes Caramuel Lobkowitz, whose work presents a "new face of scholastic erudition".[55] Playing on the title of the work, Brucker says that the mathematics course was audacious[56] and the course on Aristotelian logic identified what was true and false in Aristotle's method. Lobkowitz not only clearly stated in his introductions to his works that he loved truth more than Aristotle,[57] and included a discussion of the new philosophy in his texts but also set out a philosophical system that was not Aristotelian in design. It is clear from Caramuel Lobkowitz that eclecticism was not just a Protestant method, although the name seems to have been used primarily by them, for he states that he is following the lead of Clement of Alexandria and quotes the same passage in Clement that Vossius had quoted to establish that eclectic philosophy is the best method.

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[54] See, for instance, C. Trinkaus, *In Our Image and Likeness: Humanity and Divinity in Italian Humanist Thought*, 2 vols., London 1970; E. Kessler, "Die verborgene Gegenwart Ockhams in der Sprachphilosophie der Renaissance," in: W. Vossenkuhl and R. Schönberger (eds.), *Die Gegenwart Ockhams*, Weinheim 1990, 147-64.

[55] Brucker (as note 49), vol. IV, 133-5: "Totam illam catervam scriptorum in novem classes, sive cursus distribuit, liberalem, mathematicum, musicum, chirosophicum, philosophicum, theologicum, Scholaticum, moralem philosophicum, moralem theologicum, scripturarium. Quibus classibus tot nova scientiarum genera, tot tantasque veterum emendationes, immutationes et augmenta promittit, ut facile Hispani hominis magniloquentiam sentias. Quae tamen hoc loco referre omnia paginae angustia institutique limites non patiuntur. Quae autem in philosophia immutare sategerit, omnino hic enarranda sunt, in qua nouum eruditionis Scholasticae vultum fingere conatus est."

> Praeterea, ait, non particularis secta est eligenda; sed quidquid recte omnes dixerunt Stoici, Platonici, Epicuraei, Aristotelici, dico Philosophiam.[58]

He also uses Clement's authority to justify selecting from Aristotle what was true and rejecting what was false. The work ends with a new system of knowledge which is subdivided into *Metaphysica*, both abstract and material, *Physica*, *Angelosophia* (the study of angels), *Anthroposophia* (the study of man), *Aper Antologia* (the study of infinity) and *Theologia.*[59] Brucker says of him that he merited a name among the reformers of philosophy and that his work reclassified knowledge and included all the controversies of logic, physics and metaphysics. His course of music studied the effects and causes and his course in logic pointed out what was invalid and valid in Aristotle's logic.[60] But after praising Caramuel Lobkowitz for reading through the authorities in the history of philosophy from Democritus to Descartes, Brucker criticises him for quoting the opinions of others rather than his own judgements.[61]

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[56] J. Caramuel Lobkowitz, *Mathesis Audax, rationalem naturalem, supernaturalem, divinamque sapientiam arithmeticis, geometricis, catoptricis, staticis, musicis, chronicis, et architectionicis*, Louvain 1694.

[57] J. Caramuel Lobkowitz, *Rationalis et realis philosophia*, Louvain 1692, fol. aiij: "Agor quidem, non ex Stagiritae contemptu, sed veritatis amore; amicus ipse sed magis amica veritas. Demonstrare Aristotelm non contempsisse, cum mihi illum proposui tanquam lucem, quae mean doctrinam illustraret. .... Sane Aristoteles semper mihi semper mihi lux est, dux non est."

[58] Ibid., fol. aiij.

[59] Ibid., 437-75.

[60] Brucker (as note 49), vol. V, 134.

[61] Ibid., 135.

Of all the scholastics Brucker finds the most to commend in the Jesuits, many of whose works he personally owned. He praises Vallius' logic, remarks that Tellez' *Summam philosophiae universae*, which had been printed again in 1644 in Paris, contained questions in theology that interested philosophers, and notes that among the irrelevant arguments there are interesting topics, particularly in physics. But he reserves particular praise for Toledo who had made an important distinction between his method, which establishes the true Aristotelian method of philosophizing, and the scholastic method.[62] Brucker also praises Arriaga for having weighed objections to topics in the *Physics* and then answered his own objections, but comments that it was sad that a learned man with such an acute mind and so knowledgeable about the observations of recent philosophers should have been inhibited by scholasticism.[63] The section ends with an essay on the causes of the end of scholasticism in which Brucker argues that it declined because of the introduction of a more accurate method of reasoning, better mathematics, and an accurate method of demonstration which demolished Aristotle's uncertain principles. In place of scholasticism, a sober and modest method of philosophizing was instituted and the weaknesses in natural law were overcome by the philosophising of Hugo Grotius and Samuel Puffendorf.[64]

The so called "genuine Aristotelians" were divided into two groups, those who, Brucker said, tended toward atheism and were directly or indirectly influenced by Averroes, and those who followed the Christian Aristotelianism of Melanchthon. Among the first group the most prominent were Pietro Pomponazzi, Cesare Vanini, Augustino Nipho, Pietro Victorio, Zabarella, Francesco Piccolomini, Jacob Mazzoni, Andreas Cesalpino, and Cesare Cremonini. Brucker devotes most space to Pomponazzi, trying on the one hand to describe Pomponazzi's claims that miracles had a natural basis and on the other excusing him for reasoning badly because he followed Aristotle's belief in immaterial substances in the mind.[65] Brucker excuses Vanini of impiety on the same grounds. That Brucker attaches great importance to the new translations of Aristotle is clear from his praise of Marcus Antonius Maioragius[66] for his translation of Aristotle, which Melanchthon followed and which, Brucker seems to imply, made a change in philosophy possible.[67] Of the Italian "genuine Aristotelians", Zabarella is singled out for taking Aristotelian philosophy away from the *abstrusiora philosophiae Peripateticae mysteria* and taking it to its true source. Brucker particularly praises Zabarella's logic, which he says, others, in particular Keckermann, followed. Again Brucker excuses Zabarella for not disagreeing with Aristotle on the question of the immortality of the soul on the grounds that Zabarella was expounding Aristotle himself.[68]

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[62] Ibid., 139.

[63] Ibid., 139: " Quas licet, praecipue in physicis, haud raro dimisisset, methodum tamen Scholasticorum ubique adhibuit, nempe ut objectionum pondera exponeret, et ad illas responderet."

[64] Ibid., 147-8.

[65] Ibid., 180.

Brucker is less critical of the German Aristotelians who followed Melanchthon's lead in Germany, where, he maintains, Aristotelianism flourished until the end of the seventeenth century, because the German Protestant philosophers had to debate Catholic controversies and in particular issues arising from Catholic scholastic metaphysics and syncretism.[69] He particularly admires two groups of Protestant Aristotelians, one of which included Melanchthon,[70] Jacob Schegk,[71] and Nicolas Taurellus[72] in the sixteenth century and the other to which

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[66] C. H. Lohr, *Latin Aristotle Commentaries II,* Florence 1988, 239-40. Maioragius' writings were printed in the north: for instance his *Paraphrasis in IV libros De caelo*, Basel 1554, his *Paraphrasis in ll libros De generatione et interitu*, Basel 1554, while his *De arte rhetorica explanationes*, first printed Venice 1545, was reprinted in Cambridge as late as 1728.

[67] Brucker (as note 49), vol. IV, 193: " In philosophia autem novum quid, ut erat mos aevi istius, molitus non est, sed interpretendo Graecum Aristotelis textum, ostendere, quid Stagiritae visum fuerit, contentus, sectariam viam cum aliis ingressus est. Quae quoque caussa fuit, cur Philppum Melanchthonem et Joannem Caesarium, philosophum et medicum Germanum magni faceret, eo quo utrumque perspicue mentem Aristotelis explicuisse crederet, placeretque viro eleganter docto, quod viam atque aditum ad Aristotelis opera munire voluissent tamque egregiam scientiam, iam pridem barbarorum commentariis..."

[68] Ibid., 202.

[69] Ibid., 243.

[70] Ibid., 278-84.

[71] Ibid., 292-6.

[72] Ibid., 300-12.

Christian Dreier,[73] Melchior Zeidler, Hermann Conring[74] and Jacob Thomasius[75] belonged in the seventeenth.

Brucker sets out to place Melanchthon in a good light by pointing out aspects of his thought which seem to follow the eclectic method as Brucker defines the term. He quotes from Melanchthon's *De Studiis corrigendis*:

> Nolo philosophando quenquam nugari: ita enim fit, ut communis etiam sensus oblivscare. Sed ex optimis optima selige, eaque cum ad scientiam naturae tum ad mores formandos attinentia.[76]

Brucker gives a detailed recount of Melanchthon's discussions of the various methods of the other Greek sects and reasons for preferring clearer and simpler Aristotelian method to Platonic one. Although Melanchthon praised Platonic ethics and warns of Aristotle's incorrect doctrine on the eternity of the world, he praised Aristotle's well organised dialectic and clear description of nature. Brucker was particularly anxious to emphasise that these Protestant Aristotelians did not follow the Italians in their implied atheistic adherence to Averroes. Brucker praises Taurellus for a virtue which Brucker himself had: the ability to examine what was good in authors with whom he did not completely agree. For example, Taurellus insisted that the errors of the other Aristotelians, Piccolomi, Caesalpino, Vallesius, and the Coimbra commentators, could be identified, and that their work should be discussed. Taurellus follows this approach with Caesalpino when in his *Praefatio Auctoris ad lectorum* where while he criticises Caesalpino's adherence to the Averroist notion of the unity of the intellect, Brucker notes that nothing in Caesalpino's ethics was against Christianity.[77] And when he describes Taurellus' criticism of Caesalpino[78] for employing sources drawn sometimes from

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[73] Ibid., 333-5.

[74] Ibid., 324-33.

[75] Ibid., 335-7.

[76] Ibid., 280-1.

[77] Nicolaus Taurellus, *Andreai Caesalpini Itali, Monstrosa & superba Dogmata, Discussa& Excussa*, Frankfurt 1597, 25: "Hoc iure tamen affirmare ausim nullam in Ethnicorum scriptis impietatem hac una inveniri: maiorem, Deus hic est Caesalpinianus, quem in tot discerpit particulas, quot in hac rerum universitate putat esse substantias. Quo posito non tam Deus efficiens rerum causa erit, quam constituens. Ut vero per se est Deus & ab omni materia separatus..."

[78] Brucker (as note 49), vol. IV, 303.

Aristotle, sometimes from Averroes and sometimes from Thomas Aquinas, Brucker praises Taurellus' claim that Aristotle is enough of an authority.[79] In particular he emphasises Taurellus' defense of a method of philosophising which was not against God, "for a philosophy which was the gift of God is not against God, and *scientia* can not lie and errores are not caused by philosophy but philosophers."[80] Brucker ends the section excusing Taurellus' adherence to Aristotelianism by saying that, had he lived at a later time, Taurellus would have added much to philosophy for he had a natural propencity for eclecticism and a freedom of philosophising. However, he laments that Taurellus lacked the occasion and the correct time to develop his philosophy, both of these being, he believed, necessary for eclectic philosophy to flourish.[81]

To these should be added two Aristotelians whose views of the history of philosophy deeply influenced Brucker, Jacob Thomasius[82] and Hermann Conring.[83] He praises Jacob Thomasius, teacher of Leibniz and father of Christian Thomasius, whose attack on the Stoics, *De Exustione mundi Stoica* and *Praefationes et orationes*, criticised the atheism inherent in certain doctrines of the Greek philosophers. Brucker used this in his own *Historia critica philosophiae* when he discussed the Stoics and their physics. Conring was perhaps even more influential. Known today more for his political writing, it was Conring's *De Hermetica medicina*,[84] an attack on Kircher's view that the Egyptians had a sophisticated natural history of medicine,[85] which served as the basis for Brucker's critique of pre-Greek philosophy. Brucker quotes Conring's' Aristotelian distinction between practical knowledge and theoretical knowledge and his belief that philosophy must have a high degree of complexity in its argument, and in particular that it must use logical demonstration. This argument proves to Brucker's satisfaction that the Egyptians did not have philosophy and science because they only had arithmetic in their mathematics and experience in their medicine, while the Greeks did have philosophy because they used logical demonstration from the time of Thales.[86]

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[79] Ibid., 308:'...ac qui sese putant tum demum optime philosophare quando vel Aristoteli, vel Averrhoi, vel D. Thomae, alive cuipiam mordicus addicti, vel fraude, vel arte quidivis ad magistri sui praeceptatuetur accommodate ... Ut quod tit propositum est obtineas: sola tibi satis est unius Aristotelis auctoritas"

[80] Brucker (as note 49), vol. IV, 306 "... Philosophiam, quae Dei doneum esset, Deo non adversari, et quae scientia esset, mentiri non posse, adeoque errores non philosophiae, sed philosophorum esse, ipse narrat."

[81] Ibid., 309: "Neque haec magnopere miranda sunt ita evenisse; nam licet Taurello non defuerit ingenium vere eclecticum, et libertas quaedam sentiendi atque philosophandi haud inconcinna, destitutus tamen occasione, favoreque temporis et circumstantiarum reliquarum, sine quibus eclectica philosophia non gignitur, ad nativum eius indolem pertingere non potuit."

[82] Ibid., 335-8.

[83] Ibid., 324-33.

[84] H. Conring, *De hermetica medicina libro duo*, Helmstedt 1667, 329: "Optimo enim et non satis luadando consilio ubique historiam philosophiae iunxit, cuius cum tot hactenus in hoc opere specimina dederimus, totiesque ad eum provocaverimus, praesertim in historia philosophiae Aegyptiacae..."

There is one philosopher missing here: Sturm, whom Brucker places with the Syncretists and not with the Aristotelians. Although Brucker admits that Sturm was learned, pious and very studious, he regards Sturm's efforts to reconcile distinctly different philosophies as "noxious".[87] Brucker's interest in isolating the essential doctrines of each of the Greek sects made it possible for him to write clear summaries of their dogmas which made an important—indeed, necessary—contribution to the history of philosophy. As a result he was able to distinguish between Platonic and Neoplatonic doctrines. However, it also had another result, for Brucker was not only interested in the purity of doctrines, but criticised all those who combined Greek philosophy with Christianity, as did Sturm's eclectics or many of Morhof's *novatores*. Thus Gassendi and Lipsius were criticised, like Sturm, for combining new philosophy with Aristotle. As a result Brucker did not give these philosophers credit for their innovations and many interesting figures have been little studied. Recent work on Gassendi and Lipsius indicates how neglected these philosophers have been. The result for the study of the Aristotelians were unfortunate in the extreme. By dividing the eclectics from the Aristotelians, the dynamic relationship between Aristotelian philosophers and other seventeenth-century philosophers was cut. This historiographical error is only now being corrected.

The scholastic philosophers and "genuine Aristotelians" could have had a very different afterlife had not all scholastic philosophy been taken as one and labelled regressive, or had the "genuine Aristotelians" not been identified as irreligious and their natural philosophy neglected. By the time of Adolph Frank's *Dictionaire des Sciences philosophique* the Scholastics were mentioned only as part of the Coimbra group,[88] and the "genuine Aristotelians" were re-labelled as Italian "atheistic" Aristotelians, while Pomponazzi[89] and Cremonini[90] were transformed into exponents of intellectual liberalism. The German Christian Aristotelians who influenced Brucker and in particular Conring and Thomasius had a secret life as indirect influences, the former in the assessment of "barbarian" philosophy and the later in discussions of the doctrines of Stoicism. But Sturm and his generous view of history were forgotten once Brucker had condemned him as a syncretist.

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[85] Athenasius Kircher, *Oedipus Aegyptiacus*, Rome 1652.

[86] Conring (as note 84), 169-72. For a further discussion of the influence of Conring on Brucker's definition of philosophy see C. W. T. Blackwell, "Thales philosophus," in: D. R. Kelley (ed.), *History and the Disciplines*, Rochester 1997.

[87] Brucker (as note 49), vol. IV, 770-2.

Brucker complained that natural philosophy in Aristotle was vague and uncertain, that his moral philosophy was based on the felicity of civil society and a wrong definition of virtue, and that his followers had a false respect for the antique. This was a new view of past traditions. Neither Sturm nor Morhof would have had the notion of a false respect for the antique, for Sturm believed in—and indeed was trying to recreate—an integration of the changes in seventeenth-century philosophy with what he saw to be the dynamic approach of Greek philosophers who had taken what was relevant from the past and added their own new opinions, while Morhof described those followers of Greek sects who developed new philosophical positions within these traditions as *novatores*. Nowhere is the difference between Brucker and Morhof clearer than in their classification of Telesio whom Morhof starred as the first real *novatores* and Brucker classified as a sectarian philosopher.[91] Brucker concludes his section on the "genuine Aristotelians" with an overview which, while it praises the renewal of Aristotle from the "squalor" of peripatetic philosophy and admits that there had been several important contributions made during this period, also insists that there was little understanding of "truth" in the philosophy of the ''genuine Aristotelians'' and the followers of other Greek sects because of their *praeiudicia auctoritatis*. This led them to join their philosophy with that of ancient philosophical sects in order to philosophise.[92]

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[88] A. Frank, *Dictionnaire des Sciences philosophique*, Paris ^{3}1885, 284-5.

[89] Ibid., 1360-4. See J. E. Renan, *Averroes et l'Averroisme*, Paris 1982, ^{2}1861, ^{3}1866.

[90] Frank (as note 88), 322.

[91] Brucker (as note 49), vol. IV, 455-60.

Brucker's final volume discusses the philosophy of those he names eclectics, Cardano, Bruno, Campanella, Bacon Descartes, Hobbes, Thomasius, Leibniz and Locke. It ends with a summary of the four branches of philosophy, logic, natural philosophy, metaphysics and ethics. Discussion of Aristotle while describing seventeenth-century eclectics by this time has almost completely vanished. While Aristotle's name does not appear in the index of the five volume, discussion of contemporary logic includes a description of Ramus and Locke and their attack on Aristotle. But perhaps what is most telling in the chapter, *De Reformation philosophiae rationalis recentiori aetate tentata* is the claim of complete novelty for Locke's logical method. Locke's book *On the Human Understanding*, said Brucker, explained and delineated a new building, it can be sought in vain not only in Plato and Aristotle, but in Descartes, Gassendi, and others who wrote before Locke. It rejected all opinions and philosophised by a consideration of the human intellect and its conscience. It can not inaptly be called a history, but one not written from books but internal experience.[93] In natural philosophy Isaac Newton was equally a model, being superior in geometry to Descartes and in optics to Kepler. He followed the perfect scientific method:

> He judged that natural philosophy should not develop without the experimental method in which causes are derived from the most simple principles of things and nothing is accepted in place of the principle that does not agree with phenomena. That hypotheses are not accepted or received in physics unless their truth has been examined. That kind of philosophizing observes a double

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[92] Ibid., 340: "Cuius causa potissimum in praeiudicia auctoritatis, sectae et antiquitis coniicienda est, quibus nuntium illi non miserunt, qui philosophiam a barbarie vindicare aussi sunt."

[93] Ibid., vol.V, 609, "Ipsum opus novum intellectus humani explicati et delineati aedificium sistit, quod non modo in Platone et Aristotele, sed in Cartesio quoque, Gassendo aliisque recentioribus, qui ante Lockum scripsere frustra quaeras. Abiecit enim omnes omnino opiniones, et ex consideratione humani intellectus et conscientiae sua philosophandum esse consuit. Unde humani intellectus historiam non inepte appellaveris, non ex libris est experientia interna conscriptam..."
The young Brucker was greatly influenced by Locke's philosophy while he was a student in Jena (1714-20). See my "Epicurus and Boyle, LeClerc and Locke: 'Ideas' and their Redefinition in Jakob Brucker's *Historia philosophia doctrinae de ideis*, 1723," in: M. Fattori (ed.), *Il Vocabolario della Republique des Lettres Terminologica Filosofica e Storia della Filosofia Problemi di Method*, Florence 1997, 77-92.

> method, analytic and synthetic and that the energy of nature, and simpler laws of energy must be deduced from certain select phenomena and from these the arrangement must be discovered by the make up of the rest. He selected the very best method of philosophizing for example he deduced the explanation of the world's system from the theory of gravitation and demonstrated the nature of universal gravity was in bodies which he proved by very certain appearances. This he did by mathematical demonstration.[94]

What we see here is a clear change in what is judged to be the correct method in natural science. While for Sturm new information gained through experiment was to be added to information taken from past authorities, Morhof was closer to Brucker, but wrote before Newton's work became known. His rejection of mathematics as a major tool was, therefore, not a rejection of Newtonian mathematics but of Descartes' use of mathematics on topics such as the study of corporeal substances which could not be studied mathematically, while Brucker was well able to use and understand Newton.

It is common to speak about the seventeenth-century changes in science as a revolution, but I. Bernard Cohen has pointed out that this was a later, eighteenth-century, concept.[95] From what we have seen here, it is clear that, although all three eclectic philosophers were well aware that they were living in a period in which knowledge was expanding rapidly, not even Brucker went so far. Brucker was looking for originality of thought rather than revolution, and within that context praised Bacon, Locke, and Newton (among others). But although he used Luther as a model of an independent thinker who developed his original system of thought, another model was Aristotle. This was an Aristotle who was to be imitated not because of the way he reasoned scientifically, but for the way in which he constructed a complete philosophical system. As Brucker pointed out in his introductory remarks, Aristotle wrote the first complete system of philosophy. Indeed when Brucker examined seventeenth-century philosophers, studying their basis of reasoning in natural philosophy and distinguishing the new philosophy from that of Aristotle, not everything was rejected. Sturm, Morhof and Brucker all accepted the experimental method advocated first by Bacon but conclusively demonstrated for the wider public by Robert Boyle and the others at the Royal Society, but equally they all accepted Aristotelian logical demonstration. Not all of Aristotle's philosophy was rejected even by Brucker, and while the doctrine of substantial form was attacked, it was readily admitted by both Morhof and Brucker that Aristotle's reasoning was better adapted to metaphysics than to physics. The history of the study of Aristotelian logic in the eighteenth century is a topic which deserves further attention.

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[94] Ibid., 641: "Ad aliud ergo philosophiae naturalis genus deveniendum esse iudicavit, quod experimentale esset, et in quo ex simplicissimis principiis rerum caussae derivarentur, nihil autem principii loco assumeretur, quod nondum ex phaenomenis comprobatum fuerit, quodque hypotheses non comminsceretur, nec in physicam reciperet, nisi ut quaestiones, de quarum veritate disputetur. Hoc philosophandi genus duplici methodo uti observult, analytica et synthetica, et illa quidem naturae vires, legesque virium simpliciores ex selectis quibusdam phaenomenis deducendas esse, ex his deinde per synthesin reliquorum constitutionem esse tradendam. Quam philosophandi rationem cum omnium optimam iudicaret; eius illustre exemplum dare constituit, mundani systematius explicationem ex theoria gravitatis deducendo, demonstrandoque gravitatis virtutem universis corporibus inesse, idque apparentias certissime evincere. Quibus positis et mathematica argumentatione demonstratio."

[95] I. B. Cohen, "The Eighteenth-Century Origin of the Concept of Scientific Revolution," in: *Journal of the History of Ideas*, 37 (1976), 257-88.

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